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ON NECESSITY OF DEVELOPMENT OF INSTANT INTERPLANETARY TELECOMMUNICATION BASED ON SOME GRAVITATIONAL PHENOMENA FOR REMOTE MEDICAL DIAGNOSTICS AND TREATMENT

Aleksey Anatolievich Zakharenko
International Institute of Zakharenko Waves
Address: 660014, ul. Chaikovskogo, 20-304, Krasnoyarsk, Russia

ABSTRACT

This report discusses the possibility of instant interplanetary telecommunication based on some gravitational phenomena. This is possible because of the existence of new four-potential waves that can propagate in a vacuum. These new waves propagate due to coupling among the electrical, magnetic, gravitational, and cogravitational potentials. Their propagation speed can be several orders faster than the speed of light in a vacuum representing the today speed of interplanetary communication. The communication with the speed of light (i.e. electromagnetic waves that propagate due to coupling between the electrical and magnetic potentials) requires a time delay of 8 to 20 minutes for the distance between two neighbor planets such as Mars and Earth. Therefore, this slow speed of light is relatively enough for remote control of robots but unacceptable for remote medical diagnostics and treatment of humans-colonists on one of neighbor planets to Earth. This is true because in-time proper remote medical diagnostics can save lives of many humans in new far worlds.

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Keywords: Instant interplanetary communication, fast four-potential waves, gravitational phenomena, telemedicine, remote medical diagnostics and treatment.

INTRODUCTION

All the neighbor planets to the Earth represent an interest for the human civilization concerning space missions to them and this interest increased for the last half century. Space missions became possible due to the rapid development of space technologies in many countries on our planet. One of the neighbor planets called Mars is the leader for today regarding the maximum number of space missions already accumulated by this red planet. Therefore, development of communications between Earth and Mars is one of the problems that excite researchers, engineers, and a broad ring of space specialists for the last several decades.

This problem of proper communications between the neighbor planets was stated before the first unsuccessful missions launched to Mars in October of 1960 by the Soviet Union. The problem is in a huge time delay in 8 to 20 minutes for any signals sent from one planet to the other. This problem has arisen from the large distance between the planets because any communications are based on the electromagnetic waves propagating in a vacuum with the speed of light. However, the problem of this huge time delay was partly resolved and therefore, successful missions by the National Aeronautics and Space Administration (NASA, the United States) frequently reach the red planet since 1964. Since 1998, 2003, 2011, and 2013 several space missions were prepared by Japan, Europe, China, and India, respectively. In May 5, 2018 there is one of the suitable days when Earth and Mars are properly positioned to permit a direct route to the red planet.

This enhanced attention to the red planet is also coupled with possible future missions that can move several humans to Mars. Elon Musk, the famous engineer from the United States has a strong team of engineers and space specialists that can probably realize human's dream to move even several thousands of humans-colonists to the planet. It is expected that this target can be reached already in this century. However there is still unresolved problem of instant interplanetary communications to have something like the one developed on Earth that already occupies a planetary budget of several trillions of the United States dollars. Any communication methods developed on Earth are based on the electromagnetic waves that propagate in the free space with the speed of light. This speed is fast enough to instantly communicate

Corresponding author e-mail: aazaaz@inbox.ru

among people on our planet and even for the system Earth-Moon. However, it is useless when a human will want to have an instant reply from humans-colonists settled on Mars. To improve telecommunications with Mars, the NASA is developing the first interplanetary laser communication link. The $300 million experiment by the NASA will connect robotic spacecrafts at the red planet with scientists back on Earth via a beam of light traveling over 300 million kilometers.

The theory recently developed by the author in several published papers (Zakharenko, 2016, 2017a, 2017b) allows humans to develop instant interplanetary, interstellar, and even intergalactic communications based on new four-potential waves. These new four-potential waves include gravitational phenomena and can propagate in a vacuum due to some coupling among the electrical, magnetic, gravitational, and cogravitational potentials. This differs these new four-potential waves from both the purely electromagnetic waves and the purely gravitational waves. The gravitational waves can also propagate with the speed of light in a vacuum. The existence of the gravitational wave and its speed were predicted by Einstein (1916). 100 years later, a group of over thousand researchers (Abbott *et al*., 2016) has experimentally confirmed the existence of the gravitational waves propagating with the speed of light. The analogy between the electromagnetic waves and the gravitational waves was first found by Heaviside, (1893). Therefore, the coupling between the gravitational (gravitoelectric) and cogravitational (gravitomagnetic) subsystems like the coupling between the electrical and magnetic subsystems was studied during the 20th century. For instance there is the famous book on the subject by Jefimenko (2006). Füzfa (2016) has evaluated some weak interactions between the electrical or magnetic subsystem with the gravitational or cogravitational subsystem.

The new four-potential waves (Zakharenko, 2016) can propagate in both solids and a vacuum with speeds significantly faster, namely ten orders faster than the speed of light. This fast speed of propagation of the four-potential waves is already appropriate for development of instant interplanetary telecommunication based on some gravitational phenomena for remote medical diagnostics and treatment. One of the hottest applications of instant interplanetary telecommunication is the interplanetary telemedicine because it demands instant responses from both remote patients and remote health care staff. It is expected that the interplanetary telemedicine can be readily implemented in the network of the developed earth telemedicine.

The earth telemedicine, also known as the earth telehealth, is rapidly developed in the United States, Canada, and the European Union for the last two decades. However, it is necessary to look back to the 1940s when radiology images in Pennsylvania were sent for 24 miles between two townships via a telephone line. This is the world's first case of an electronic medical record transfer. A Canadian doctor built upon this technology in the 1950s, constructing a teleradiology system that was used in and around Montreal, Canada. In 1959, clinicians at the University of Nebraska, USA were the pioneers in the use of video communications for medical purposes when the university established a two-way television setup to transmit information to medical students across campus. Five years later this setup was linked with a state hospital to carry out video consultations. Many achievements in the development of the earth telemedicine were summarized in the review paper by Zundel (1996). Also, some recent historical records on the development of the earth telemedicine can be found in review books (Vladzymyrskyy, 2008) and (Dumanskyy *et al*., 2013). The successful development of the earth telemedicine lies in offering quality products and cutting-edge technologies that bring medical care to rural and underdeveloped areas around the globe. Today some successful telemedicine companies offer their services for patients from ~ 100 developed and developing countries. It is predicted that the global market for telemedicine technologies including software, hardware, and services will assess at $50 billion by 2020.

This report has an interest in any development of instant interplanetary communications. Therefore, this work offers the four-potential waves that can propagate fast enough for the instant interplanetary telemedicine. The next section acquaints the reader with problems of developments of some research methods. The third section provides some theoretical backgrounds and schematically demonstrates the communication possibility for the instant interplanetary telemedicine.

MATERIALS AND METHODS

The Research Methods

In this century, a large work must be carried out for realization of the instant interplanetary communication. It is obvious that it is a complex problem inside of a multidisciplinary research arena. A successful realization requires the taking into account some gravitational phenomena. It is necessary to state that the last century has demonstrated the successful development of the electrical engineering and this century is for a broaden development of gravitational engineering. It is possible that it will lead to the creation of a global research organization called the Institute of the Gravitoelectrical and Gravitoelectronics Engineers (IGEGEE). This is similar to the Institute of Electrical and Electronics Engineers (IEEE) that publishes over 100 scientific journals. The IEEE was created in 1963 by merging of two research organizations: the Institute of Radio Engineers (IRE) established in 1912 and the American Institute of Electrical Engineers (AIEE) established in 1884.

To have a success in the development of gravitational engineering leading to creation of the instant interplanetary communication, the following several research directions must be involved in one tie:

1) It is necessary to develop theoretical methods that can provoke new experiments, creation of new materials, and proper educate the engineering and health care staff. For instance, pioneer theoretical work by Zakharenko (2016) requires creation of precise experimental tools for measurements of some material parameters of extremely weak exchange interactions mentioned in the next section for continues media such as solids and a vacuum. Also, it is necessary to further develop theory of propagation of surface waves, interfacial waves, guided waves in plates, etc.

2) The experimental methods of study are also very important. The creation of the cutting-edge experimental infrastructure concerning investigations of various gravitational phenomena will allow humans to reach new horizons in understanding of the nature of gravitation and its various applications. These applications will not stop at achievements in the instant interplanetary communications.

3) For the purpose of application of gravitational phenomena, the material sciences will study commercial applicability of materials and find competitive materials. It is expected that the material sciences can even create novel materials with suitable properties that will make feasible all human's dreams concerning creation of various gravitational technologies.

4) The engineering sciences must incorporate achievements in the theory, experiments, and material sciences for constitution of various technical devices. The main purpose can be a complete integration of gravitational technologies into the well-developed electromagnetic technologies.

5) The proper training of the health care staff for instant diagnostics and treatment of remote patients of colonists settled in a neighbor planet. The being of space pioneers in unfriendly environment will frequently require from the health care staff quick and nonstandard responses to protect the health of remote patients. Today there are no existing technologies that can provide instant telecommunication between the earth health care staff and a remote patient on a neighbor planet. The 20 minutes time interval required for an electromagnetic signal from Earth to reach Mars can significantly complicate surviving of the remote colonists. This can be one of fatal factors for remote colonies. Therefore, the utilization of the fast four-potential waves for the instant interplanetary telecommunication can keep a solid bond between any remote colony and developed earth civilization.

Of all the important research directions listed above, only the first theoretical part can be found in published literature since 2016. To be familiar with the original theoretical research, the reader mush study the recent theory developed in (Zakharenko, 2016, 2017a, 2017b). These obtained theoretical results are already enough to initiate any development of the other research directions. The following section will discuss the theoretical backgrounds that will allow humans to develop the instant interplanetary telecommunication.

The major theoretical findings

First of all, it is necessary to state that theoretical work (Zakharenko, 2016, 2017a, 2017b) relates to the wave propagation in the continuous media such as solids. Theoretical work by Zakharenko (2016) has developed thermodynamics, material parameters' definitions, constitutive relations, equations of motion in both the differential and tensor forms, eigenvalue and eigenvector problem, boundary conditions. As a result, theory by Zakharenko (2016) has soundly demonstrated that the new hear-horizontal surface acoustic waves (SH-SAW) coupled with the electrical, magnetic, gravitational, and cogravitational potentials can propagate in solids. It was noting that any acoustic wave propagating in solids is approximately five orders slower than the speed of light (C_L) in a vacuum, $C_L = 2.99792458 \times 10^8$ [m/s]. This is also true for the new four-potential SH-SAW (4P-SH-SAW) propagating in a solid because the contributions from the electrical, magnetic, gravitational, and cogravitational subsystems only slightly accelerate the surface wave. Theoretical work by Zakharenko (2017a) has demonstrated the existence of new interfacial 4P-SH-wave managed by the common interface between two dissimilar solids. Theoretical work by Zakharenko (2017b) was focused on further development of the eigenvalue and eigenvector problem and provided several different sets of possible eigenvector components.

However, a solid and a vacuum represent different continuum media. Indeed, any acoustic wave cannot propagate in a vacuum. To distinguish two continua, it is natural to use the subscript "0" for all the vacuum material parameters. And all the material parameters for a solid are further written without this subscript. It is well-known that the speed of the electromagnetic waves (V_{EM}) in a solid is as a rule slightly slower than the speed of light in a vacuum, $V_{EM} < C_L$. According to the experimental results obtained in (Abbott *et al*., 2016), the speed of the gravitational waves in a vacuum is also equal to the speed of light. However, nothing is still known about the speed of the gravitational waves in solids. Therefore, it is not good idea to develop communications based on the gravitational waves because the electromagnetic wave communication technologies are already well-developed and the vacuum speeds of the electromagnetic and gravitational waves are equal. The

electromagnetic wave propagates due to the coupling between the electrical and magnetic potentials and therefore, represents a two-potential wave. Analogically, the gravitational wave propagates due to the coupling between the gravitational and cogravitational potentials and therefore, also represents a two-potential wave. Theory by Zakharenko (2016) provides extra two new waves that can propagate in a vacuum and a solid. These extra two new waves already relate to the four-potential waves because their propagation is coupled with all four aforementioned potentials. Their speeds Λ_{01} and Λ_{02} in a vacuum (and therefore Λ_1 and Λ_2 in a solid) can be significantly faster than the speed of light in a vacuum. Let's demonstrate and discuss this peculiarity below.

With the vacuum material parameters, one can find the following equalities, where the first represents the useful physical dimensions of some combinations of the parameters:

$$[\varepsilon_0\mu_0]=[\gamma_0\eta_0]=[\xi_0\beta_0]=[\zeta_0\lambda_0]=[\mathrm{s}^2/\mathrm{m}^2] \quad (1)$$

$$C_L=\frac{1}{\sqrt{\varepsilon_0\mu_0}}=\frac{1}{\sqrt{\gamma_0\eta_0}} \quad (2)$$

$$\Lambda_{01}=\frac{1}{\sqrt{\zeta_0\lambda_0}}\rightarrow\left(10^{11}\div10^{16}\right)C_L \quad (3)$$

$$\Lambda_{02}=\frac{1}{\sqrt{\xi_0\beta_0}}\rightarrow\left(10^{12}\div10^{17}\right)C_L \quad (4)$$

In the expressions written above, the vacuum material parameters ε_0 [s^2/m^2] and dimensionless μ_0 are well-known and called the electrical constant and the magnetic constant, respectively. Also, the vacuum gravitational parameters γ_0 [$kg\times s^2/m^3$] and η_0 [m/kg] are called the gravitic constant and the cogravitic constant, respectively. The other exchange parameters ζ_0, λ_0, ξ_0, and β_0 of a vacuum are called the gravitoelectric constant [$kg^{1/2}\times s^2/m^{5/2}$], the cogravitomagnetic constant [$m^{1/2}/kg^{1/2}$], the cogravitoelectric constant [$s/(kg^{1/2}\times m^{1/2})$], and the gravitomagnetic constant [$kg^{1/2}\times s/m^{3/2}$], respectively.

For a solid, these four expressions can be inscribed in the following forms:

$$[\varepsilon\mu]=[\gamma\eta]=[\xi\beta]=[\zeta\lambda]=[\mathrm{s}^2/\mathrm{m}^2] \quad (5)$$

$$V_{EM}=\frac{1}{\sqrt{\varepsilon\mu}} \quad (6)$$

$$V_{GC}=\frac{1}{\sqrt{\gamma\eta}} \quad (7)$$

$$\Lambda_1=\frac{1}{\sqrt{\zeta\lambda}}\rightarrow\left(10^{11}\div10^{16}\right)C_L \quad (8)$$

$$\Lambda_2=\frac{1}{\sqrt{\xi\beta}}\rightarrow\left(10^{12}\div10^{17}\right)C_L \quad (9)$$

So, the fast four-potential waves propagating in a vacuum with the speeds Λ_{01} (3) and Λ_{02} (4) are already suitable for the instant interplanetary communication. Also, it is still not possible to say that the speeds of the electromagnetic and gravitational waves in a solid are equal, i.e. $V_{EM} = V_{GC}$ is questionable because nothing is still known about proper measurements of speed (7) of the gravitational waves in solids. However, it is expected that $V_{GC} < C_L$ but it is not obvious that $V_{EM} = V_{GC}$. The values of the fast speeds Λ_1 (8) and Λ_2 (9) of the four-potential waves in solids were evaluated in (Zakharenko, 2016) with the known typical values of the other material parameters of the solids. As a result of the evaluation, speed Λ_2 (9) can be one order faster than speed Λ_1 (8) for some solids. However, it is not true for all solids and it is possible that for solids there can be both cases of $\Lambda_1 > \Lambda_2$ and $\Lambda_1 < \Lambda_2$.

The values of fast speeds Λ_{01} (3) and Λ_{02} (4) of the four-potential waves propagating in a vacuum were evaluated with the use of the evaluated values of speeds Λ_1 (8) and Λ_2 (9) for a solid. It is assumed that speeds Λ_1 (8) and Λ_2 (9) must be slightly slower than the corresponding vacuum speeds Λ_{01} (3) and Λ_{02} (4). This means that $\Lambda_1 < \Lambda_{01}$ and $\Lambda_2 < \Lambda_{02}$. These inequalities can be true because a similarity to the known inequalities $V_{EM} < C_L$ and $V_{GC} < C_L$ is assumed. So, for today only there are precise measurements of the speeds V_{EM} and C_L. The modern tools for precise measurements of the wave characteristics V_{EM} and C_L are well-developed because the last century can be called the century of the development of the electrical engineering.

This century is for the development of the gravitational engineering. Therefore, some proper experimental setups can be constructed for precise measurements of the gravitational wave speed V_{GC} for a large number of various solids. However, proper measurements of the exact values of fast speeds Λ_{01} (3) and Λ_{02} (4) for a vacuum represent the greatest interest. It is natural that the values of vacuum material parameters ζ_0, λ_0, ξ_0, and β_0 can be precisely measured in space experiments. Also, any cutting-edge experimental techniques for precise measurements of all the tensor values of the material parameters ζ, λ, ξ, and β for solids with different crystal symmetries at both the earth and microgravity conditions are welcomed. Indeed, the values of fast speeds Λ_1 (8) and Λ_2 (9) for different solids must be also known. The development of the experimental techniques can significantly move our civilization ahead towards the well-developed instant interplanetary communication.

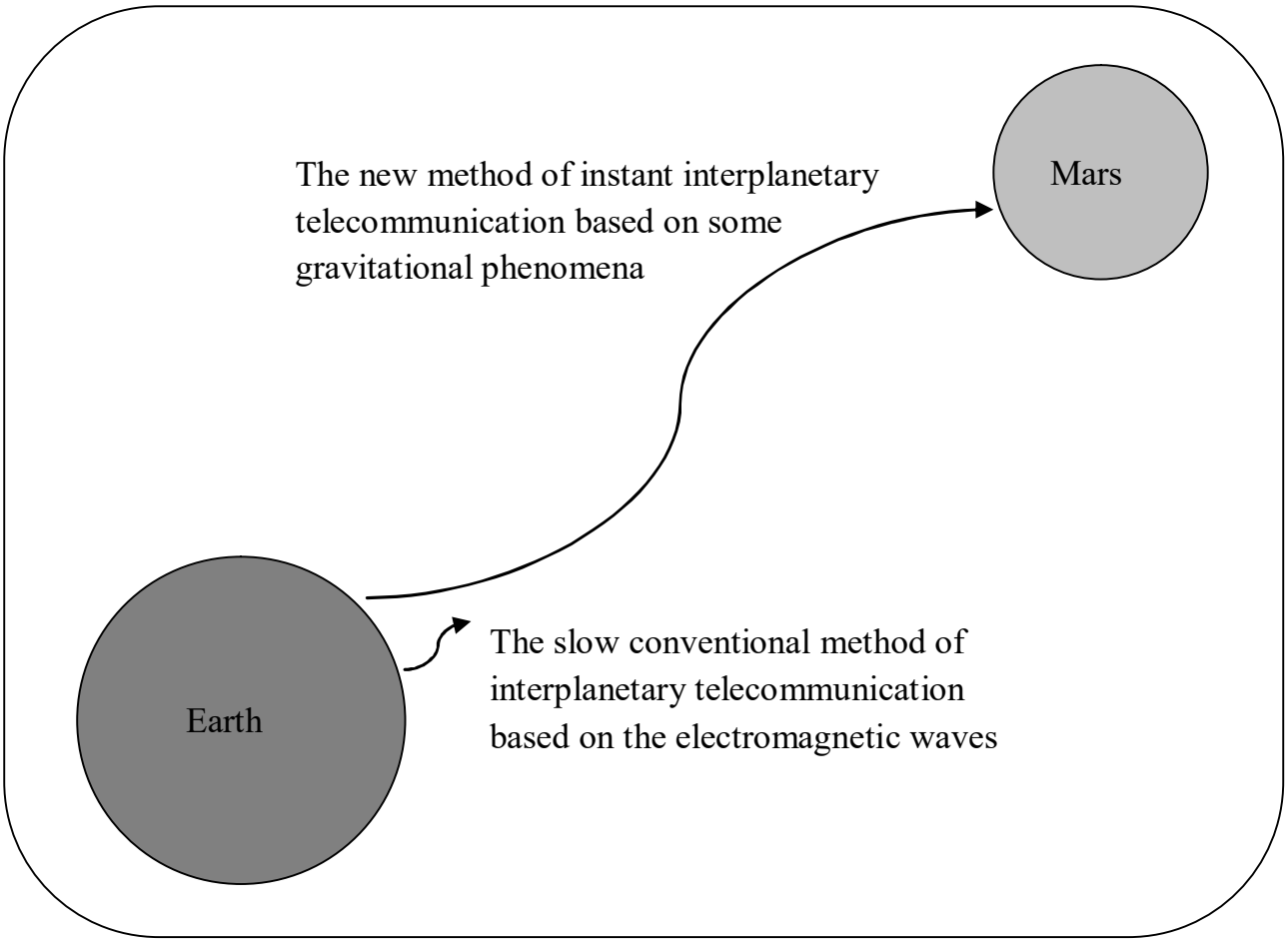

Fig. 1. The interplanetary telecommunication methods between Mars and Earth: the slow method based on the electromagnetic waves propagated in a vacuum with the speed of light (C_L) and the instant method based on some gravitational phenomena that can offer a telecommunication speed as fast as by about $10^{11} \times C_L$.

This will allow humans in the future to have the instant interplanetary telemedicine. Let's discuss such possibility.

The interplanetary communication is schematically shown in Figure 1. With the neighbor planets Earth and Mars, these two planets can be used as a startup for the development of the instant interplanetary communication. It is natural because the human civilization settled in the natural spaceship called Earth has a dream to establish several remote settlements consisting of thousands of colonists on the red planet. This crowd-like voyage it is planned can be feasible already in this century. The well-developed instant interplanetary communication will allow the remote colonists to feel that they are solidly coupled with the earth civilization like the mobile phone connection between Australia and the European Union or the United States. For this purpose, both the fast four-potential waves propagating in the free space (vacuum) with the corresponding speeds Λ_{01} (3) and Λ_{02} (4) can be suitable. It is even possible to use one wave (3) as the first channel and other wave (4) as the second channel to have a two-channel connection. Indeed, it is possible to utilize these two channels to transfer the same information simultaneously via both the channels for a solid connection.

Figure 2 shows the possibility for the realization of the instant interplanetary telemedicine. All the Martian colonists must have smart devices, for instance, sensor armlets for permanent health monitoring in real time regime. The local Martian connection can be organized with the convectional communications that are well-developed on Earth: mobile and cable telephony and internet. However, the interplanetary communication must be based on the fast four-potential waves propagating with speeds Λ_{01} (3) and Λ_{02} (4). This connection can be also called the instant interplanetary internet. This fast connection will allow for the colonists to instantly transfer various video and audio signals as well as large archived packages including health care information. With the instant interplanetary internet, the Martian colonists can have instant 24/7 technical and

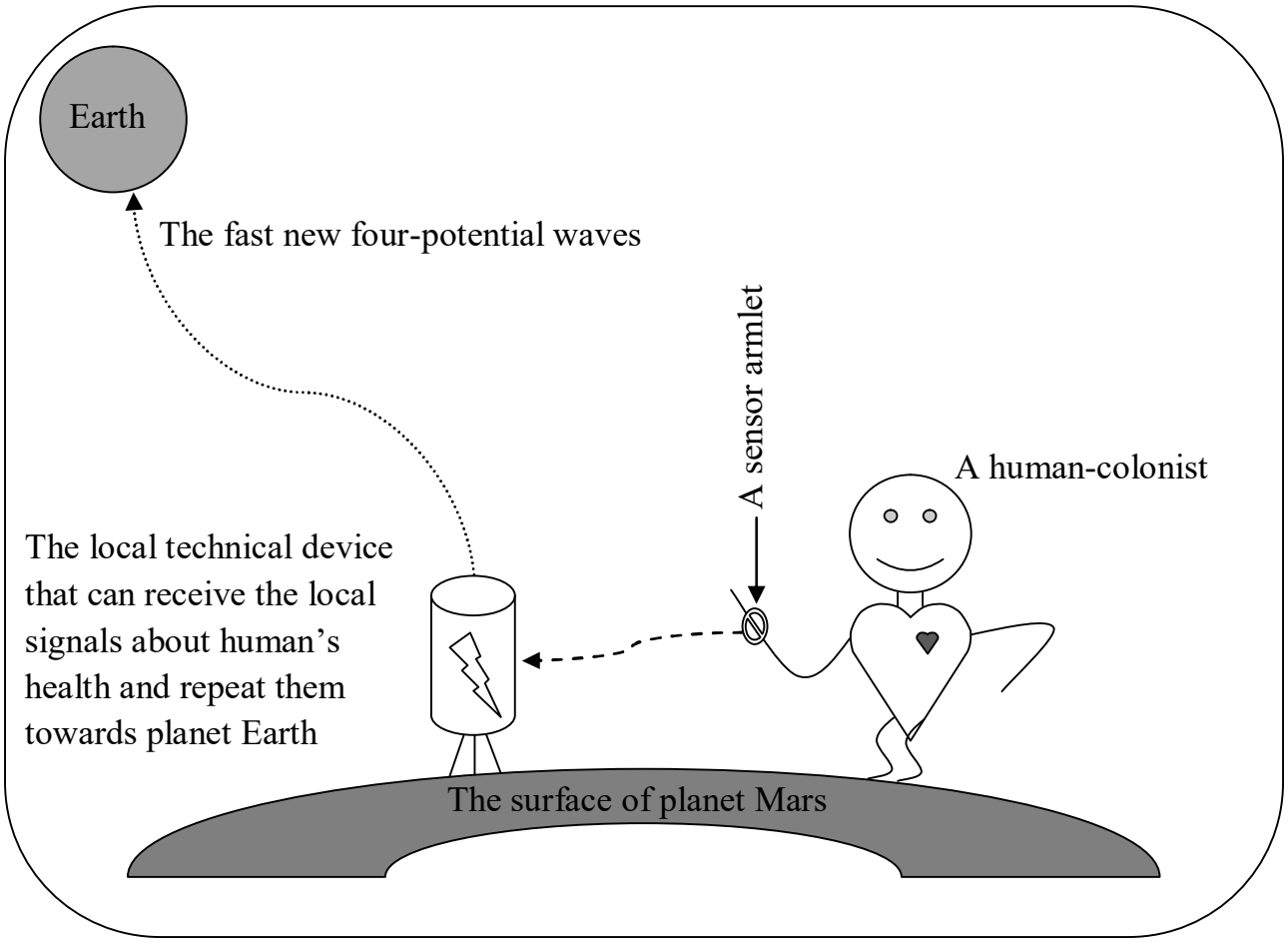

Fig. 2. The possible in-time proper remote medical diagnostics of a human living on Mars by a group of medical experts on Earth. The human must have for instance, a sensor armlet on a hand. And this smart handy can send ceaseless signals about human's health to a local receiver for instant interplanetary communication that then repeats these received signals with the fast new four-potential waves towards a Earth receiver. On planet Earth the in-time received signals can finally recorded and further distributed to all involved medical experts living on Earth.

health care support from a large number of corresponding high-quality specialists on Earth. So, it is possible to have the instant interplanetary, interstellar, and even intergalactic communications. Speeds Λ_{01} (3) and Λ_{02} (4) are fast enough for the purposes. However, the instant communication can instantly transfer information but not human's bodies and technical equipment. So, any possibility of instant transportation of massive objects to some suitable remote worlds is still a great problem for today.

CONCLUSION

These short discussions have demonstrated a possibility for instant interplanetary telecommunications among neighbor planets in the same star system. However, it is expected that this telecommunication method based on some gravitational phenomena can be also plausible for communications among neighbor star systems and even neighbor galaxies of our Universe. For this purpose, one of two (or even both) fast new four-potential waves can be used because they are several orders faster than the speed of light, i.e. the speed of the electromagnetic waves in a vacuum. One of the hot applications of the instant telecommunication is in-time proper remote medical diagnostics and treatment of humans on the ways towards new far worlds and already directly on places of remote colonies. This requires creation and broad development of interplanetary telemedicine.

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