Interview: Dr. Claudio Maccone

Protecting Mankind From Extra-Terrestrial Threats

*At the Astrobiology Science Conference 2012, "Exploring Life: Past and Present, Near and Far," in Atlanta on April 18, Oyang Teng of the LPAC Basement Research Team interviewed Dr. Claudio Maccone, Technical Director of the International Academy of Astronautics, on humanity's current vulnerability to extra-terrestrial threats such as asteroids, comets, and supernovas, and the needed international collaboration to overcome such dangers. Dr. Maccone is the author of "*Deep Space Flight and Communications*" (2009).*

The interview took place following Dr. Maccone's presentation at the conference on humanity's lack of preparedness for an asteroid or cometary impact. A video of the interview can be seen at http://larouchepac.com/basement.

U.S. Department of Energy

"We need to make a real leap forward," Dr. Maccone said, to defend the Earth from an impact by an asteroid or comet, "that would cause millions, if not billions, of casualties."

Oyang Teng: Dr. Maccone, I wanted to start by asking you to summarize—you started your presentation saying, the punchline is, we're not prepared—but maybe you could say briefly what the nature of, first the short-term threat, or maybe the immedidate threat as you see it, of an impact event on the Earth.

Claudio Maccone: Well, the situation is pretty clear nowadays. We know that there are about over 300,000 rocks in the Solar System, basically asteroids, but also big, dead comets, or comets, or whatever. And the vast majority are rocks smaller than 1 kilometer [in diameter]. Now, this means that it is not easy to see them with telescopes. Nowadays, we can see them because we have automatic systems of telescopes taking care of the orbits immediately—as soon as they take the digital picture of the part of the sky with the asteroid—they can immediately compute the orbit, and find out whether these are old, known objects, or new, unknown objects.

Anyway, there are so many small rocks, that really hoping that none will ever hit the Earth is crazy. So, we must be prepared for that. And actually, there is a JPL [Jet Propulsion Laboratory] website that everybody can see—it's public access, not secret—listing a set of asteroids or near-Earth objects that have a certain, higher-than-zero probability of hitting the Earth sometime in the future, or anyway coming close to the Earth, sometime in the future, in a century or so.

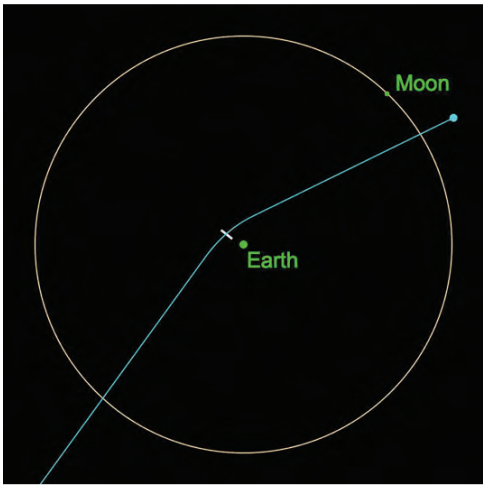
So this is the first basic fact that I would like to point out.

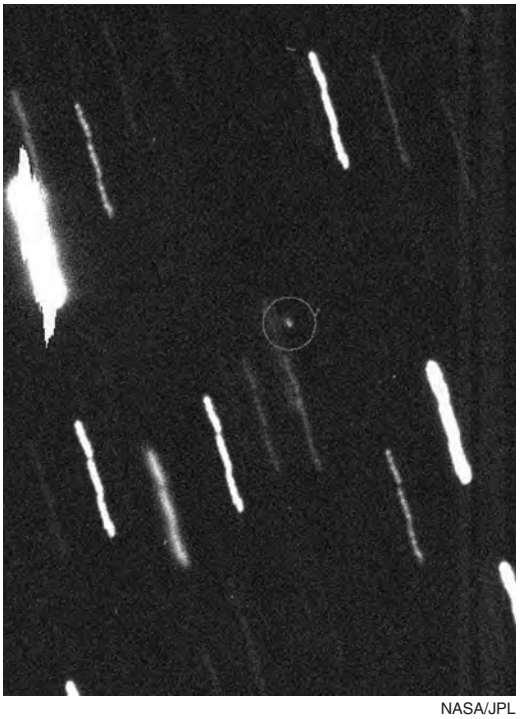
There is a second fact. The orbits of these bodies are not precisely known. Just to put it in simple terms, students at university learn that if you have an ellipse, which is the orbit of an asteroid around the Sun, you must specify *six* parameters in order to have this ellipse precisely located in time and space.

Now, these parameters are totally arbitrary because there are the so-called integration constants of three differential equations of the second order—a Newtonian equation. So there are six parameters for each asteroid. Absolutely arbitrary.

Now, the point is that, we do not know *exactly* what the numbers that speak to these parameters are. Actually, we derive likely values of these numbers from the orbits of some 30 bodies or so, the most massive bodies in the Solar System.

So, let me put it in clear terms. The 30 most massive bodies in the Solar System have orbits that can be computed by today's computers, but all the rest, which means 300,000, 400,000, have to be, so to say, described on the basis of the





NASA/JPL

The danger to humanity posed by an asteroid or comet, is "a really serious problem," Maccone stated. Shown: a schematic of the possible trajectory of the near-Earth asteroid Apophis in 2029; a NASA image of Apophis (circled) in space (right).

first 30 bodies; and so there are certainly uncertainties in the values of these parameters.

Now, this is a really serious problem, because we do not know exactly whether any one of these bodies is going to hit the Earth or not.

We Need a Real Leap Forward

Is it a question then of getting more ground-based or space-based instrumentation to track these objects, or can we do it with the existing tracking that we have, but we just need to put more resources behind it?

Well, certainly, the tracking must be done. There is no question about it. And also, the discovery of more objects that we still don't know about has to be done. But this is not enough. We need better computers, and I'm hoping that when the quantum computer will become effective, it can solve the problem. But this is not the case yet.

But apart from all this, which is essentially a mathematical game, we need to make a real leap forward. And this is to prepare space missions capable of going out into space, away from the Earth, as much away as possible, hitting the asteroid, moving that body away from its collision course against the Earth, and so, really, literally, rescue the Earth from an impact that would cause *millions*, if not *billions*, of casualties.

If it weren't an issue of budgetary constraints right now, what, in your view, would be the next step, that would have to be taken, concrete steps, to do exactly that? What sorts of missions are we talking about?

Okay, now let me first refer to the United States, since we are in the United States. But of course, this is a problem that affects the whole of humanity. Well, in the United States, before 2011, which is one year ago, NASA was planning to build two launchers, called Ares I and Ares V. And I was part of a study in 2007, led by NASA, about this thing; essentially, we had to make an assumption, just to give you an idea about what we did.

We hoped that we could have a ten-year lead time, meaning we would come to know ten years in advance whether an asteroid was going to hit or not. So, on the basis of this, then we would have planned two different space missions. The first mission to be carried forward by Ares I was a survey mission, sending the probe around the asteroid, picking up pictures, finding the mass, the shape, rotation, whatever. After that, the second mission would have arrived, launched by Ares V, and that would have been a much more effective thing, shooting six projectiles, 1.5 tons each, against the asteroid, in order to move it away from the collision course.

If this was not enough, then, we also considered the possiblity of using nuclear weapons. Now I am completely aware that nuclear weapons in space are not loved by anyone, but especially not by the ecologists. I am quite aware of this. But the point is simply that, if the body is too massive, and the six projectiles that I just mentioned are not enough to move it away, there is no other way than using a nuclear explosion, not on the body itself, but at an optimal distance from the body, so that the gamma rays produced during the explosion, *push* the asteroid away, because of the momentum of the radio waves, of the gamma rays, and so on. So this is the technique, basically.

Now, the point is that, just one year ago, your President Obama decided to give up these two rockets, Ares I and Ares V, and replace them with a single transportation system. So this, in plain words, means that we have to redo a whole lot of calculations, because we are using different launches. And, at the moment, no such system is in existence at all, so if we discover that there is something on a

collision course with the Earth, at the moment, we are unable to do anything against it.

NASA/MSFC

President Obama has eliminated the program for the Ares I and Ares V rockets, that could have been part of a defense of Earth. Now, said Maccone, "if we discover that there is something on a collision course with the Earth, at the moment, we are unable to do anything against it." Shown: an artist's concept of the Ares-I and larger Ares-V rockets.

Russia's Strategic Defense of Earth

You mentioned the importance of the role, in this case, of three major players. One, is the international scientific community; two, is the space agencies, such as NASA, ESA [European Space Agency], etc.; and three, is the military, because of their organizational capabilities, and their access to weapons. So I'm wondering, the one proposal that's come out in the last year from the Russian government, by the name of the Strategic Defense of Earth, is a transformation of what was once a military defense project for missile defense on Earth, to a defense against these extra-terrestrial impacts. Do you think that that is a useful model for the kind of program approach to deal with this?

It is a useful model, and at least it is something better than we have in the West—because we have *nothing* at the moment. So, we should really pay careful attention to what the Russians are doing, because they were good enough—let me use these words—to convert a system that had been designed during the Cold War times, from a defense against American missiles, to defense against asteroids and comets. So they are setting an example. And this means that international cooperation in this field is absolutely useful, not to say, indispensable.

Now apart from the Russians, of course, the Europeans are considering the problem seriously. I am aware that a few years ago, a new group of people taking care of planetary defense in Europe was created. But of course, we also expect other contributions, for instance, from China; for instance, from India; for instance, from Japan, and so on.

So, the bottom line is that the organization to which I belong, and of which I am a director, the International Academy of Astronautics, organizes worldwide conferences about planetary defense, once every two years. Last year, it was held in Romania, with attendees from all over the world. Next year, it will be hosted by NASA in Flagstaff [Arizona], with a visit, of course, to the meteor crater nearby.

And so, I would encourage young people, who have no idea about planetary defense, or anyway, want to get involved with this kind of problem, for the benefit of the whole of humankind, to attend this conference. Because in these meetings, you really meet, not only the experts, but also the decision-makers, those who have the power to transform projects into reality. So, my suggestion is that if you are interested in that, you should show up there.

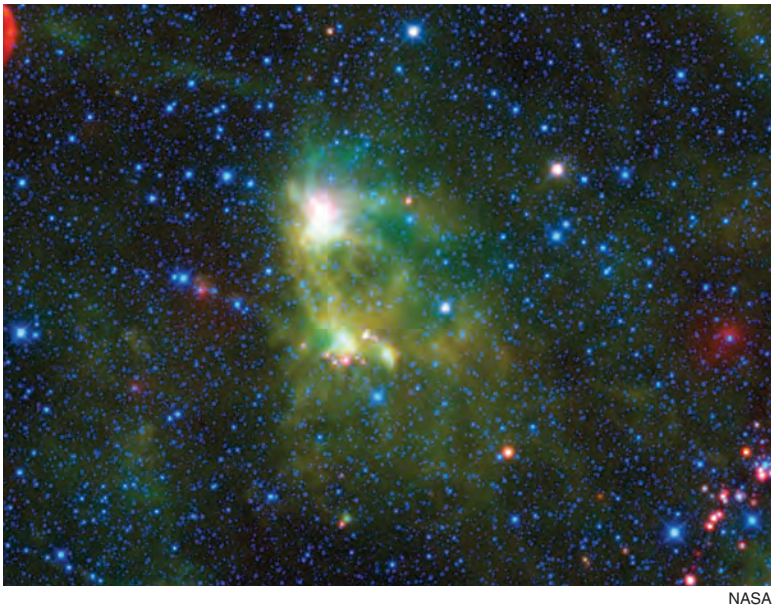
Galactic Threats

On the nature of the threats: We know that we are not simply dealing with asteroids and comets, but that we live in a galaxy that is constantly evolving, and we know, still, very little about it. Could you speak to what you think are the broader, longer-term questions in terms of planetary defense, and how we, the human species, has to manifest itself in terms of our activity in space?

Sure. There are certainly other terrible threats to life on a small planet, such as we are. Let me just mention some.

First of all, I would mention supernova or nova explosions. These are simply explosions of stars that have come to the end of their life because they have nothing to burn any more, no more fuel to burn. Now these we know do occur: for instance, the Kepler supernova in 1604. They explode everywhere in the galaxy, so if there is one exploding next to us, we can only keep our fingers crossed. Because if the distance is something greater than 3,000 light years, we might possibly survive. If it is not, then, I cannot see any hope for us. We will be literally fried. And there is no way to shield humanity against that, as far as I can see, at least for the moment. So this is certainly a danger.

Next: There are other dangers. For instance, if you have a binary star, that is, two stars revolving around each oth-



NASA

Among the "terrible threats to life" on our small planet, are supernova or nova explosions. "They explode everywhere in the galaxy, so if there is one exploding next to us, we can only keep our fingers crossed," Maccone said. Shown: The red circle in the upper left, near the constellation Cassiopeia, is SN 1572, or the Tycho supernova, about 3,500 light years away.

er, and if you have a planetary system around each of these stars, that is, planets revolving around each of these stars, numeric simulation plainly shows that, if this goes on for ages, millions or billions of years, the planets may, sometimes, jump from orbiting around one star, to orbiting around the other star, because the gravitational pull brings them into such a condition.

Now the point is that, in the end, all planets in such a double system, are going to be ejected. And this is awful! Because it means that, in the galaxy, there are a number of so-called "rogue planets," which are precisely that. Planets that have been ejected by gravitational reason. So they just travel along a straight line until they find some mass that deflects them. And just suppose, unfortunately, that one such rogue planet is coming toward the Solar System. I don't mean it's going to hit the Sun, or something like that. It could pass close enough. Well, that would disrupt the gravitational stability of the Solar System.

So the orbit of the Earth, rather than being nearly a circle, could become an ellipse again. And you can easily imagine the consequences on humanity living on this planet.

So, that is a terrible threat, and again, at the moment, I cannot see any way we can imagine to get rid of that, except for carefully watching the sky as much as possible in advance. And, if such a body arrives, try to disrupt it, you know, to shoot nuclear weapons against that, in order to at least reduce the mass that would deflect the Earth from its orbit.

The 'Extraterrestrial Imperative'

My last question is, you ended your talk saying, at the moment, given where we are, we're really still as good as the dinosaurs. And it is the case that, thinking about this planetary defense, forces you to think about evolutionary times. But if we project forward, there is a term that was coined by a space philospher and scientist, Krafft Ehricke, he called it the "Extraterrestrial Imperative." That humanity has an extraterrestrial imperative which is really an evolutionary imperative to not only leave the Earth, in the same way a baby has to leave the womb, but to develop the Solar System and beyond. And that this is actually a cultural, economic, and scientific imperative.

So, I would like you to speak to your thoughts on this idea, and maybe where you see humanity in the next 50 years, or 100 years.

Thank you. Well, you are touching a subject that I really love. Actually, I wrote a book called *Deep Space Flight and Communications*. Now, "deep space flight" means what it really is: going to the edge of the Solar System, and possibly, beyond.

Now, at the moment, unfortunately, we do not have the technical capabilities of planning for a starship that would leave the Solar System and reach even the closest stellar system, which is Alpha Centauri, at 4.37 light years away. I am glad to say, that in the last year, DARPA [Defense Advanced Research Projects Agency], the military advanced research project, and NASA Ames Research Center, organized a conference held in Orlando [Florida] last year in the Fall, gathering all the scientists who are trying to solve this problem of how to get to the nearest stars.

We do not have the solution, but at least, we came to know each other. Serious proposals were discussed, for instance, anti-matter proposals—I'm just mentioning one, the one that I like most. But nobody really knows which one could be selected. Anyway, this doesn't really matter.

At the moment, at last, NASA and DARPA realize that this has to be studied, even if we are in financial troubles that we know about.

So, for the future generations, I can only encourage more interest in these kinds of things. The time will come when we will be able to reach at least the nearest stars, and that could mean the rescue of humankind from certain death in case an asteroid or supernova or a rogue planet destroys life on Earth.

Okay, well, that's a note of optimism!

Thank you very much.

Thank you Dr. Maccone. And I guess we'd better get started.