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October 25, 2017

**Re: Nomination of Michael Chang for the 2018 Schmidt Science Fellow program**

To the 2018 Schmidt Science Fellows Selection Committee,

It is my absolute pleasure to write a letter of reference for Michael Chang, who has been a science writer for the Office of Research Trainees (ORT) at the University Health Network (UHN) in Toronto, ON for the last two years. Michael’s role involves writing short, insightful stories around recent scientific publications in a captivating fashion.

The genre of short stories is relatively new. It was implemented when Michael applied for a writing position at the ORT Times. During his application for a writing position, he submitted a couple samples of his short stories that captured a unique perspective on the world. The ORT Times ran a pilot of sample short stories over the first year and with enough interest in the short stories genre and style of his writing, they have become a permanent fixture in the ORT Times. Michael’s short stories demonstrate what happens when you bring together the highest level of scientific curiosity and an intellectual spark. He does a tremendous amount of reading to understand the intricacies and complexities of diverse fields and brings together distinct concepts to create new ideas the world has never seen. It is difficult to describe the feeling Michael’s writing brings to readers, you simply have to read and experience it for yourself (see sample story attached below).

Upon learning more about the Schmidt Science Fellows program, it’s easy for me to say that Michael Chang is the ideal candidate given his energetic personality and intellectual curiosity in a vast number of subject areas as seen in his writing. Through Michael’s writing, he has been able to make extraordinary achievements on the readership and have a lasting impact on the research trainees at UHN around the world.

Yours Truly,



**Nisha Ganeswaren**

**Office of Research Trainees Coordinator**

# The True Nature of Reality

*Mathematical models can make powerful predictions, but they may not correctly represent nature.*

Announced on Feb 22, 2017

By Michael Chang, ORT Times Writer and UHN Trainees

Ancient civilizations were undoubtedly captivated by the wonders of the night sky, as evidenced by their highly accurate documentation of planetary movement, constellations and the location of the North Star. Ancient astronomers measured the North Star’s location with such precision that Hipparchus (190–120 BC) was able to detect a subtle drift in its location, 1.4⁰ per century. Although ancient astronomers could measure the rate of Earth’s axial precession (figure, left panel), they had no real understanding of why the heavens were constantly shifting—likely because their entire model of the solar system was incorrect due to misunderstood passages in the bible and anthropocentric ideas of humanity’s place in the universe. It is remarkable how the ingenuity of the human mind could create mathematical models that placed Earth at the center of the solar system while correctly accounting for the observed motion of planets from Earth. Indeed, Ptolemy's geocentric model (150–1450) described planetary motion so successfully that it remained the conventional view of the solar system for over a millennium despite several philosophical concerns relating to the imaginary equant point and the function of epicycles (figure, right panel).



*A spinning top experiences precessional motion (left). Ptolemy's geocentric model was based on the theory of epicycles (right).*

Today, modern science has become sophisticated enough to measure even the subtle precession of subatomic particles and predict their behaviour based on quantum mechanical models. However, reconciling the philosophical implications of quantum mechanics with our perception of reality remains just as challenging. In the 1970s, Lauterbur and Mansfield discovered that the hydrogen protons from water in our bodies can precess in alignment with a powerful magnetic field and then resonate when perturbed at a specific frequency with a secondary perpendicular magnetic field. The resonance of these protons throughout the body can be processed to determine the tissue from which they originate and form high contrast images. Medical students are often taught that charged subatomic particles with (a non-zero) spin act like tiny magnets with angular momentum and thus experience precession when placed in magnetic fields. This revolutionary concept forms the basis for non‑invasive magnetic resonance imaging (MRI) that allow neuroscientists to see inside the brain, surgeons to plan for resections, and pregnant mothers to see the beating heart of their unborn child. In reality, however, subatomic particles do not physically spin or have angular momentum. Yet, MRI physics continues to be taught with classical concepts because it is easier to comprehend and visualize. Furthermore, the quantum mechanics of MRI is unnecessary for its operation, so ignoring it helps to spare instructors from astute students who may begin to question its philosophical implications.

In fact, Schrödinger wrote that the philosophical implications of his own contributions to quantum mechanics reminded him of the theory of epicycles[1(link is external)](http://www.informationphilosopher.com/solutions/scientists/schrodinger/Quantum_Jumps_II.pdf). Schrödinger felt that the complex mathematics behind quantum mechanics could make powerful predictions, but it may not represent what is physically happening. Notwithstanding humanity’s great achievements, the true nature of reality remains shrouded. Until we uncover it, we continue to stare into the vastness of the universe with wonder, just as our forefathers had before us.

Original Source: <http://www.uhnresearch.ca/news/true-nature-reality?redirect=ort/ort_February2017>