2020 Virtual DDA Meeting: Special Sessions

The 2020 virtual DDA meeting will have three special sessions.

The dynamics of building a dynamics community

While some portions of dynamical astronomy are computational in nature, the science in our field is, ultimately, done by people. This special session is devoted to covering material relevant to the dynamics of our scientific community ranging from inclusive best practices in research contexts to outreach and education efforts in training emerging dynamical astronomers.

This special session will take the form of a live, interactive workshop led by our invited speaker, Sherard Robbins (we will post updates as the details of converting this to virtual format are worked out!). Contributed abstracts for this session are also welcome. Authors will upload pre-recorded talks or poster pdfs by July 27th to give meeting participants time to view them. A live discussion session will be scheduled for authors to answer questions and discuss their papers. Note that abstracts submitted to this special session will not count against the limit of one abstract per meeting participant.

The Main Belt: A complex dynamical system

The Main Asteroid Belt between Mars and Jupiter represents a repository of the primordial building blocks of the planets and is also recognized as the primary source of Near Earth Asteroids (NEAs) and meteorites. The Belt we see today is the outcome of over 4 Gyr of physical and dynamical evolution whose effects continue to this day and have been superposed on its original properties. The picture of a dynamic Belt forms the framework for identifying source regions and likely parent bodies of asteroid families, meteorites and NEAs, for understanding the impact record on the Moon and planets, as well as for learning about the earliest stages of the formation of our solar system. This session focuses on models of the formation and dynamical evolution of the Belt and its link to the meteorite and NEA population. Topics include: the original state of the belt following its formation and the mechanism(s) that caused its massive depletion, the formation and evolution of asteroid families and the detection of ghost families, asteroid collisions and active asteroids, and asteroidal material delivery to Earth as revealed by meteorites and the planetary impact crater record.

Confirmed invited speaker list: Federica Spoto, Mikael Gravnik, and Renu Malhotra

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Artificial celestial bodies as a dynamical laboratory for astrophysical and celestial dynamics

The last decade has seen a rebirth in astrodynamics, the subfield of celestial mechanics that has traditionally emphasized only the engineering and experimental aspects of dynamical astronomy. This renaissance has been spurred on not only by the recent sobering implications of human-made orbiting debris (the new “Vermin of the Sky”), but also by the ability to perform computer simulations of ever-greater sophistication and by the realization that chaos has played a fundamental role in the dynamical evolution of astronomical bodies. Like the exotic orbital configurations of many exoplanetary systems, the three-dimensional complex of space debris has stimulated a renewed interest in applied and fundamental research in astrophysical and celestial

dynamics. Given the contracted timescale necessary for observation and the precision of such observations, artificial celestial bodies make for a unique and intriguing dynamical laboratory. Indeed, circumterrestrial orbits can possess an extraordinarily rich spectrum of dynamical behaviors, and, from a mathematical perspective, have all the complications that make them very interesting candidates for testing the modern tools of chaos theory.

Even the planar, circular, restricted three-body problem (PCR3BP) — perhaps the simplest dynamical model that approximates the motion of real objects (both natural and artificial) in the Solar System — has orbital solutions that display a surprising degree of complexity. While the structure of the phase space of the PCR3BP is far from being fully understood, modern geometric insights of Hamiltonian dynamical systems theory have revolutionized the design of space trajectories. The manifold dynamics that permit the ‘Interplanetary Transport Network’ have been shown recently to play a significant role as a short- term transport mechanism for Jupiter-family comets, among other astronomical bodies. The proposed special session will help to build these strong connections between the fields of astrodynamics, planetary science, and applied mathematics, and will show the dynamical astronomy community that seemingly more mundane celestial bodies, like the Earth’s navigation satellites, still require research on a level more fundamental than tracing the microscopic influence of yet another tesseral harmonic.

Confirmed invited speaker list: Alessandra Celletti, Shane Ross, and Ioannis Gkolias

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