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## 9th workshop on Catastrophic Disruption in the Solar System (CD9)

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## **9th Workshop on Catastrophic Disruption in the Solar System (CD9)**

During the formation and evolution of the Solar System, repetitive accumulation and destruction of small bodies occurred and left behind traces in various forms, such as small bodies varying in sizes and shapes, craters on surfaces, and meteorites of varying textures and structures. Collisions thus play a major role in the Solar System history. The workshop on Catastrophic Disruption in the Solar System (CD) is an international workshop held every few years since 1985 with the aim of sharing the latest research results from different approaches on this important topic and discussing the direction and ideas of new research among researchers from various fields (Davis et al., 1986; Di Martino and Paolicchi, 1994; Davis, 1999; Michel and Durda, 2004; Campo Bagatin, 2009; Michel et al., 2015; Holsapple and Housen, this issue). The 9th workshop was held in May 14–17, 2018, at a conference room in Ikuta shrine site located in the center of downtown Kobe, Japan, and included 78 participants. It was held just before the arrival of Hayabusa2/JAXA spacecraft at asteroid Ryugu, which took place in June 2018, and OSIRIS-REx/NASA at asteroid Bennu in December 2018. The workshop was filled with enthusiastic participants, looking forward to the first impact experiment on an asteroid surface in the following year by Hayabusa2 on Ryugu and the sampling of both Ryugu and Bennu, as well as discussing future exploration of other asteroids.

The workshop consisted of the following seven sessions: space missions and observations, experiments and scaling laws, numerical modeling of shattering, collisions and small body shaping, asteroid families, a wide collisional view, and meteoritic collisional signature. Each of the invited speakers, A. Cheng (APL/JHU, USA), J.-B. Vincent (DLR, Germany), M. Arakawa (Kobe Univ., Japan), A. Stickle (APL/JHU, USA), M. Bruck-Syal (LLNL, USA), D. Cotto-Figueroa (Univ. Puerto Rico), G. Libourel (Univ. Côte d'Azur, Obs. Côte d'Azur, CNRS, France), and N. Lunning (Smithsonian Inst., USA), presented a 30-min talk. Furthermore, 38 contributed talks of 20 min each, and eight electronic poster presentations, with a flash talk of 3 min each were conducted.

This special issue consists of ten contributions, which originated from the results presented at the workshop (Holsapple and Housen, 2019; Jutzi, 2019; Sugiura et al., 2020; Raducan et al., 2020; Soldini et al., 2020; Kanamaru et al., 2019; Durda et al., 2019; Flynn et al., 2020; Murakami et al., 2020; Suzuki et al., 2020) and two additional papers on related topics (Michikami et al. 2019; Ganino et al., 2019). Proceedings of most of the eight workshops conducted until now have been published as a Special Issue of the Journal “Planetary and Space Science.” We would like to thank the journal for hosting the proceedings of this productive workshop once again.

The impact experiments by Hayabusa2 (hypervelocity impact and two samplings using also an impact) have been successfully performed and the mission returned to Earth a mass of samples from Ryugu that is 54 times the one expected. A large amount of samples from Bennu has also been successfully collected by OSIRIS-REx and will return to Earth in September 2023. Additionally, the first asteroid deflection test using the kinetic impactor technique will be performed in 2022 by the NASA DART mission that will be launched in fall 2021 to the binary asteroid Didymos. The results of this impact of a 560 kg spacecraft at about 6 km/s on the 160 meter-sized moon of Didymos, which will offer us the first impact experiment at this scale, will then be fully investigated by the ESA Hera mission, to be launched in October 2024, in early 2027. These fascinating adventures in space combined with new theories, numerical modelling, observations, laboratory experiments, and analysis of extraterrestrial material will lead to major advances in our understanding of the collisional process, with strong implications on our understanding of the Solar System history. We are thus looking forward to discussing those advances in the next CD workshops.

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## References

- Campo Bagatin, A., Michel, P., Bus, S. J., 2009, Preface to special issue VII workshop on catastrophic disruption in the Solar System, *Planet. Space Sci.* 57, 109-110.
- Davis, D. R., Farinella, P., Paolicchi, P., Zappalà, V., 1986, Summary Report on the international workshop "Catastrophic Disruption of Asteroids and Satellites" (Pisa, Italy, July 30–August 2, 1985), *Società Astronomica Italiana, Memorie* 57, 7-12.
- Davis, D. R., 1999, Introduction to the Special Section on Results from the Catastrophic Disruption V Workshop, *Icarus* 142, 3.
- Michel, P., Durda, D., 2004, Introduction to the special section on results from the 6th Catastrophic Disruption Workshop, *Planet. Space Sci.* 52, 1073-1074.
- Michel, P., Nakamura, A. M., Campo Bagatin, A., 2015, VIII Workshop on Catastrophic Disruption in the Solar System, *Planet. Space Sci.* 107, 1-2.