Satellite Large Constellations and Astronomy – what is the problem and what are we doing about it?

Plenary Session

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Since May 2019, over 2000 new telecommunication satellites have been launched to become part of large constellations. During the weeks after launch, these satellites can be spectacularly bright, forming science-fiction-esque trains that caught the public eye. Once they reach their operational orbit, the satellites become less bright, but some of them remain visible to the eye and well within the detection limit of most telescopic observations. As the number of satellites in large constellations could grow up to 100,000 over the next decade, the community has embarked on a series of studies to characterize the problem, quantify the effects on observation, and evaluate mitigation measures. Discussions are taking place with satellite operators and international bodies to define best practices and eventually set up rules to safeguard access to the night sky. I will present an overview of the problems caused by large satellite constellations. In the optical, the effect is exacerbated in the twilights and while the sun is fairly close below the horizon. As expected, it is much worse for wide-field cameras on large telescopes (consequently affecting Vera Rubin Observatory's LSST much more than most other facilities). Low- and medium-resolution spectrographs will also be affected, with the additional twist that the contamination might not be immediately detected. While the number varies dramatically from one instrument to the next and with the specific science cases, we should expect to lose 0.1-10% of the data taken during the first and last hours of the night. I will also discuss some mitigation methods that will have to be applied. Some concern the satellites themselves, others the scheduling of the observation, and the processing of the data. Finally, I will describe the ongoing efforts by the parties involved (astronomers, international bodies, satellite operators) to share the night sky while minimizing the interference on astronomy, from naked eye star gazing to observations with the most powerful telescopes.