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SPHERE+, Imaging young planets down to the snow line

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SPHERE, the high contrast imaging facility at the VLT has contributed significantly to the exploration of planetary systems, by revealing many details in proto-planetary and debris disks, by measuring the atmospheric properties of young giant planets and by deriving constraints on the giant planet population in long orbital periods. Such achievements allow us to provide a better understanding of planetary formation and evolution. The versatility of SPHERE also enables various secondary and sometimes unexpected science cases owing to a large spectral coverage from the visible to the near IR, and the availability of several observing modes as imaging, spectroscopy and polarimetry. Yet the access to the region where planets are expected to form, is not complete and still represents a challenge. To overcome this limitation larger contrasts at shorter separations are definitely required.

The SPHERE+ concept precisely aims to provide the capabilities to primarily access the bulk of the young giant planet population down to the snowline in order to bridge the gap with complementary techniques. As a second objective, SPHERE+ should be able to observe an increased sample of targets, fainter and redder than those observed in the first survey. Finally, SPHERE+ will provide a higher level of characterization of planet's atmospheres. To achieve these goals, SPHERE should be upgraded with a faster Adaptive Optics system to reach high contrasts at closer angular separations, together with a more sensitive wavefront sensor in the infrared to observe redder targets. Medium and high spectral resolution in the near infrared will be brought by a dedicated IFU spectrograph or taking advantage of the HiRISE project to combined SPHERE and CRIRES+. We will present the science cases and the technical solutions that are foreseen to reach the appropriate performances, and provide potential ways for such an upgrade.

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