# Exploring cometary interplanetary dust particles with new "eyes"

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Chondritic porous interplanetary dust particles (CP IDPs) sample reservoirs of primitive material absent in meteorites, and their properties - anhydrous mineralogy, abundant carbonaceous material and amorphous silicates (so-called GEMS) - are consistent with cometary provenance [1]. In addition, they boast the highest abundance of presolar grains detected by measurable isotope anomalies [2], some from presolar amorphous silicates [3], indicating a significant fraction of remnant presolar interstellar dust.

The first samples from a known comet, 81P/Wild 2, indicate efficient mixing of inner and outer nebula materials in the Kuiper Belt [4], but substantial damage to the sub-micron fraction from high speed capture complicated direct comparison between CP IDPs and Wild 2 *bone fide* comet dust [5]. Wild 2 dust is not a robust match to CP IDPs, calling for their reexamination with new perspective, or new "eyes". CP IDP component size distributions show that their parent bodies formed in different places/times [6] begging the question, From whence do the CP IDP parent comets hail?

New capabilities form a powerful set of new "eyes" with which to explore CP IDPs. Technical developments enable correlating TEM and NanoSIMS analysis in the same samples [7], new quad-detector systems offer rapid chemical mapping over relatively large regions with high resolution and minimal damage [8], and electron energy loss spectroscopy (EELS) can analyze organics and water [9]. Finally, combining these new "eyes" offers insight into presolar grain mineralogy and spatial correlation of organics and water in CP IDPs.

[1] Hanner M. & Zolensky M.E. (2010) in *Astromineralogy*, 2nd ed., Springer-Verlag, Berlin, pp 211-212. [2] Stadermann F.J. et al. (2006) *GCA*, **70**, 6168-79. [3] Messenger (2003) *Science*, **300**, 105-8. [4] Brownlee D.E. et al. (2006) *Science*, **314**, 1711-6. [5] Ishii H.A. et al. (2008) *Science*, **319**, 447-50. [6] Wozniakiewicz P.J. et al. (2013) *Astrophys. J.*, **779**, 164-7. [7] Matzel J.E.P. et al. (2013) *Science*, **328**, 483-6. [8] Ishii H.A. et al. (2015) *LPSC XXXXVI* #2541. [9] Bradley J.P. et al. (2014) *PNAS*, **111**, 1732-5.

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