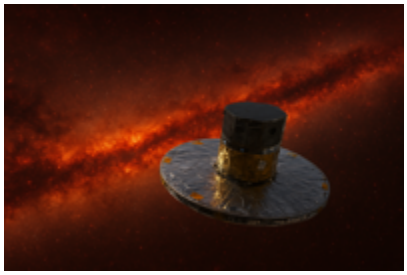

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Computing magnitudes, colours, distances at any signal-to-noise level

Wednesday 28 January 2026 09:50 (20 minutes)

While it is in general preferable to work with parallaxes instead of distances, some applications may make a conversion from parallaxes to distances desirable. At low signal-to-noise levels random noise may however cause the observed parallax to become negative. The conversion from parallax to distance has therefore to take the non-negativity of the true parallax, and distance, properly into account. This can be done by using a suitable prior. We present a rigorous prior that results in a simple "all-purpose" estimator for the distance from the parallax and its error at all signal-to-noise levels. This estimator is easy to compute with low computational effort, and thus suitable for applications to large data set. We show that the estimator provides distances that are less biased than distances computed using previous priors, and also less prone to produce "outliers" in the distances. The same approach can also be applied in the computation of magnitudes and colours from observed fluxes at low signal-to-noise levels.

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