ID de Contribution: **14**   Type: **Non spécifié**

Indirect estimation of distance of a star from apparent magnitude

Space observatory Gaia has prepared a large catalog of 1 billion astronomical objects which consists primarily of stars but also planets, comets, asteroids and quasars among others whose parallaxes are measured instead of distances (r). Bailer-Jones (\citet{Bailer-Jones}) established that distance estimation from parallaxes is not trivial once the fractional parallax error is larger than about 20\%, which will be the case for about 80\% of stars in the Gaia catalog. In the present model the distance estimates are developed through a Bayesian model using apparent magnitudes which are distant dependent intrinsic properties of stars. The proposed model is based on apparent magnitude limited distribution (viz. $\phi(m)$) constructed with the combination of the probability density function (pdf) of an absolute magnitude limited distribution $\Phi(M)$ along with a prior. The former one is constructed from real data set of Gaia Catalogue of apparent magnitudes, corrected for extinction and parallaxes of a huge number of stars. The posterior distribution of the estimated distances thus found has variances and bias under control even for a lager fractional error (viz. more than 80 \% compared to the previous work) and hence for a larger distance.

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Classification de Session: Lightning talks