



Contribution ID: 1067

Type: **Invited talk in the parallel session**

The X-ray fundamental plane of the Platinum Sample, the Kilonovae and the SNe Ib/c associated with GRBs and the fundamental plane in Fermi-LAT

Tuesday, 6 July 2021 06:30 (30 minutes)

A large fraction of Gamma-Ray Bursts (GRBs) lightcurves (LCs) shows X-ray plateaus. We analyze all GRBs with known redshifts presenting plateaus observed by The Neil Gehrels Swift Observatory from its launch until August 2019. The fundamental plane relation between the rest-frame time and X-ray luminosity at the end of the plateau emission and the peak prompt luminosity holds for all the GRB classes when selection biases and cosmological evolutions are applied. We have discovered two important findings: 1) a new class of Long GRBs with good data coverage: the Platinum Sample; 2) the Platinum, the SNe-LGRB and the KN-SGRB samples, the second sample composed of GRBs associated spectroscopically with the SNe Ib,c, the third sample composed by 8 GRBs associated with Kilonovae or where there could have been such an association, yield the smallest intrinsic scatter, $\sigma_{\text{platinum,GRB-SNe}}=0.22 \pm 0.10$ and $\sigma_{\text{KN-SGRB}}=0.24 \pm 0.12$. The highest correlation coefficients yield for the SN-LGRB-ABC sample, which are GRBs spectroscopically associated with SNe Ib/c or with a clear optical bump in the LC resembling the SNe Ib/c, ($R_{2\text{SN-LGRB-ABC}} = 0.95$), for the SN-LGRBs ($R_{2\text{SN-LGRB}} = 0.91$) and the KN-SGRBs ($R_{2\text{KN-SGRB}} = 0.90$) when the redshift evolution is considered. These category planes are reliable candidates to be used as cosmological tools. Furthermore, the distance from the Gold fundamental plane is a crucial discriminant among classes. In fact, we find that the distributions of the distances of the SNe-LGRB, SNe-LGRB-ABC, KN-SGRBs and SGRBs samples from the Gold fundamental plane are statistically different from the distribution of the Gold GRBs' distances from the Gold fundamental plane with and without considering evolution cases.

We will also show the applicability of the fundamental plane in high energy gamma-rays.

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Session Classification: Gamma-Ray Burst Correlations: Observational Challenges and Theoretical Interpretation

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