per hour. While still very preliminary and showing a substantial observational scatter, the data indicate a mean precision, for 2 arc second seeing, near 0.002 arc seconds per hour of observation and suggest that sites of exceptional seeing may regularly yield positions accurate to better than one-one thousandths of an arc second per hour.

19.07 Signal Processing of Doppler Data for the Detection of a Very-Low-Frequency Gravitational Wave Background. J. W. ARMSTRONG, JPL, F. B. ESTABROOK, JPL, L. A. REGIER, UCSD. Long period \(-10^{10}\) second gravitational radiation causes very small perturbations in the Doppler tracking record of a distant spacecraft. The fractional frequency perturbations \(\delta f/\nu\) (gravity wave strain amplitude) are expected to be \(< 10^{-15}\). At these levels a number of "geophysical" (propagation noise due to solar wind and tenuous phase scintillations) and instrumental (instability in the time standard at the tracking station) noises are important.\(^1\) For the X-band gravity wave experiment on the Galileo spacecraft, propagation noise at a level \(-5 \times 10^{-15}\) will be the leading noise source. However, the Doppler tracking system responds differently to gravity waves and propagation noise.\(^1\) In this paper we show how the differing signal and noise correlations can be used to design an optimum linear filter for the detection of a gravitational wave background. For the low signal-to-noise ratios of practical interest, the form of the filter is independent of the exact SNR. Although this filter very effectively reduces propagation noise, in practice it amplifies other noise sources having correlation functions similar to that of the gravity wave background (e.g., timekeeping noise). The net result is that improvements in detection sensitivity of about a factor of 5 appear practical. This work was supported by the NASA Astronomy/Relativity Office.


Session 20: SNR, X-Rays, Pulsars, Galaxies, Image Processing
0940–1530 (Garden Court)
(Display Presentation)

20.01 New Results from Long-Term Observations of Cosmic X-Ray Sources, M. FRIEDMANN and J. TERRELL, Los Alamos. Several long-term X-ray source periodicities have been observed using data from the Vela 5B X-ray experiment. This 3-12 keV X-ray detector yielded all-sky coverage from 1969 to 1979, though data acquisition was sporadic after mid-1976. New results observed in Be/X-ray systems include 41.5 and 187.5 day periods in GX030-1 and 4U1145-61, which confirm previous suggestions, and a new 132.5 day period for GX304-1. There is evidence for the 5.65 day optical period of 1E1445.1-6141. A suggested 111 day period for the transient A0535+26 is confirmed. A possible 26.1 day period is observed from the vicinity of 4U0115+63 and 2S0114+650. The massive X-ray binary Cen X-3 shows no regular long term period, but does have a timescale of 120-165 days for high state activity. Data for the massive binary Vela X-1 are examined for evidence of the 93.3 day period suggested by Khrusnyna and Cherepashchuk (Sov. Astron., 35, 310, 1992). A 199 day period is observed from the vicinity of 4U1915+19, thought to be a low mass X-ray. The OB system 4U1007+40 shows a probable 41.6 day period. The recurrent transient Aol X-1, which averages one eruption per year, is shown to have an underlying cycle of 124 days, with a sinusoidal walk of approximately 10% per cycle. Most of the variations can be explained by eccentric binary orbits, or precession in binary systems. This work was performed under the auspices of the US DOE.

20.02 An X-ray Survey of Main Sequence Stars with Shallow Convection Zones, by J. N. M. SCHMITT, L. GOLOO, F. P. RABBEN, J. R., C. W. MARXON, CFA, and G. A. VALENTI, Obs. Astron. di Palermo. We have conducted an X-ray survey of bright late A and early F stars on the main sequence \((T_{eff} < 6500 K, spectral types A7-F5, luminosity classes IV-V).\) Only stars listed in the Yale Bright Star Catalogue and observed by the Einstein Observatory (pointed or serendipitous survey) have been included in our sample; the sample thus consists of nearby, optically well-studied stars. According to stellar structure theory, there is a break in the above spectral range, such that all stars of later type should have surface convection zones, whereas earlier stars do not. Since stars with surface convection zones may be expected to have dynamo processes to produce magnetic fields which subsequently heat a corona, the question arises whether we can see this break in X-rays. We draw the following preliminary conclusions from our survey: single stars in the spectral range F0-F5 and luminosity classes IV-V are X-ray emitters with luminosities \((L_x/L_{bol}) \sim 10^{-5}\) for a few \(10^{28}\) ergs/sec at low X-ray temperatures \((0.2\) keV). The spread in the observed X-ray luminosities is quite small \((< 5\%\) for a factor of 5), and no significant correlation with rotation velocities or bolometric luminosities is found. The observed X-ray emission is too strong in order to be explained by the X-ray emission mechanism in early-type stars \((L_x/L_{bol}) \sim 10^{-3}\), nor are the signatures of late-type stellar X-ray emission usually explained in terms of an \(o_{-}\) or \(o_{+}\) dynamo, found; there is a lack of correlation with rotation, low dispersion around the mean and no apparent variability. We explore alternative mechanisms for coronal heating in stars with shallow convection zones at low Rosby number.