equations, as well as the Lagrangian density, in order to get validity in the general relativity environment, using Hamilton's principle in a space-time with a metric $g_{\alpha\beta}$, to be determined by the dynamical equations. We also develop a generalization of the QHD-I model Lagrangian density in order to obtain appropriate field equations for the model. Using the Equivalence Principle and the tetrad formalism we build a local inertial frame on every space-time point (LIF), described by a given coordinate set. Further, we express the Lagrangian density in terms of a LIF, with addition of the gravitational field through geometrical arguments, and then determine the coefficient of the scalar curvature. Next we derive the expression for the energy-momentum tensor, valid in the framework of general relativity and apply the mean field approximation to the baryon and meson field equations. These equations and Einstein's equation represent the formal basis for the development of an explicitly covariant neutron star model.

THE WILSON-BAPPU RELATIONS REVISITED

Rubens Freire Ferrero[1] and Erwan Lastennet[1]

Wilson and Vainu Bappu (1957) established empirical linear relationships between the absolute magnitude and the logarithmic of the emission width of Ca II H and K lines for late-type stars having chromospheric activity. The relations take into account stars of different luminosity classes and was verified from F to M stars and over a range of 16 stellar magnitudes. That work was later enlarged with new observations and stars and applied also for other chromospheric lines like Mg II h and k and Ly α after UV satellites were launched.

(a) New database on W-B relations and preliminary analysis

We have built a database (Lastennet & Freire Ferrero 1994) with selected relevant data used in these empirical relationships and we reanalise them. We determine the statistical parameters defining linear regressions between absolute visual magnitude M_V and line emission-widths W (measured at the base and as FWHM) for Ca II and Mg II lines. M_V was computed from photometric calibrations or from stellar parallaxes. The correlation coefficient ρ and the validity domain of these correlations are:

– for Ca II, $-5 < M_v < +11$ and spectral types from F8 to M6, with $\rho > 0.85$;

– for Mg II, $-5.6 < M_v < +5$ and spectral types from F0 to M5, with $\rho > 0.51$ for W measured at the base and $\rho > 0.94$ for W measured as FWHM.

(b) Discussion and Conclusions

Absolute magnitudes are the major error sources on the regression lines. Emission widths W must be corrected from rotational broadening in the case of F stars. Our results show that cold stars do not deviate particularly from the regression lines as was previously obtained by Elgaroy et al. (1990). Further work is in progress as well as the use of Hipparcos satellite parallaxes.

Elgaroy O., Engvold O., & Carlsson M. 1990, A&A 234, 308

Lastennet, E. & Freire Ferrero, R. 1994, A&AS 108, 611

Wilson O.C. & Vainu Bappu, M.K. 1957, ApJ 125, 661

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STELLAR DIFFERENTIAL ROTATION AND CLASSICAL *V.SIN I*

Rubens Freire Ferrero[1]

The knowledge of stellar $v.sin\,i$ is very important because it is linked to: stellar structure and evolution, stellar atmospheres and activity, stellar winds, double and multiple stellar systems and also to the presence of planetary systems around stars. The classical rotation theory used to determine $v.sin\,i$, assumes a rigid spherical star. But known real cases, the Sun and the giant planets, show differential rotation and geometrical distortion. Now, are stars rotating as rigid bodies or not? Until now, observations do not allow to conclude on this question due to very restrictive conditions needed: very high spectral resolution (>100 000) and S/N ratio (>300). Two opposite methods are possible:

– direct: assuming a differential rotation law, then compute stellar flux and compare to observed spectra.

– inverse: apply a deconvolution allowed by a convenient mathematical formulation of rotation.

(a) The importance of differential rotation

Theory shows that stellar rotation combined with convective motions generate meridional circulation and differential rotation (Gilman 1980), but also generate a magnetic dynamo responsible of stellar activity. Chromospheric Ly α emission from Altair (A 7 IV-V) gives an indirect evidence of differential rotation (Freire Ferrero et al. 1995) as well as Doppler imaging of very active RS CVn stars.

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