114.13

A Reanalysis of the Interstellar Medium along the Capella Line of Sight

We report on new GHS/RIST observations of the interstellar HI and DI Lyman-α lines and the FeII and MgII resonance lines along the line of sight toward the nearby (12.5 pc) star Capella. These observations were obtained at orbital phase 0.80 when the combined stellar emission lines had different shapes compared to those obtained in earlier observations at phase 0.26 and analyzed by Linsky et al. (ApJ 402, 693 (1993)). By reversing the radial velocities of the two stars we are better able to derive the intrinsic stellar profiles, especially for the Lyman α line, and therefore to determine the interstellar absorption lines more precisely.

We compare the derived properties of the local interstellar medium (D/H ratio, temperature, turbulent velocity, hydrogen column density, and gas phase abundances) for Capella at the two phases with the properties derived for the line of sight to another nearby (3.5 pc) star Procyon.

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114.14

Detection of Interstellar C I and C IV within 26 pc of the Sun
F.C. Bruhweiler (Catholic U.), A.M. Smith (GSFC/LASP), G. Perry & C.-H. Lyo (Catholic Univ.)

Data for interstellar features seen in the spectrum of α Gru (B7 IV; d = 26 pc) have recently been obtained by the Goddard High Resolution Spectrograph aboard the Hubble Space Telescope. These data have been acquired using both the G140M medium (R~25,000) and Echelle-B high (R> 80,000) spectral resolution configurations. These data are of high signal-to-noise ratio, ranging from 100 to 300. This line-of-sight (l = 350°, b = 152°) intersects the main body of the Local Cloud and the detection of excited fine-structure absorption in C I λ1335.7 indicates particle number densities in excess of n = 5 cm⁻³, much higher than the n~0.1 cm⁻³ deduced at the Sun. These data also show the first detection of both interstellar C I λ1667 and C IV λλ1548,1550 in the local ISM. The detection of C IV is inconsistent with photoionization from the hot stars of the nearby Sco-Cen association and with thermal conduction in a cloud interface. The most likely explanation implies that the C IV is formed in gas still in a recombination phase. Such ionized gas should be present due to the recent supernova event (10⁶-7 yrs) that gave rise to the local Loop I radio structure.

115.02

On observational constraints on the shape of the dark matter distribution in the model of dark matter confined Lyc clouds
V. Khersonsky, D. A. Turnshek (University of Pittsburgh)

A promising model of the Lyo clouds seen in absorption in quasar spectra was developed by Rees (1986, MNRAS, 218, 25p) (see also Ikeuchi (1991), Adv Space Res, 11, No.2, 245) and Miralda-Escudé and Rees (1993, MNRAS, 260, 617)]. In this model 'minihalos' of dark matter (DM) are postulated to provide potential wells which stabilize the Lyα clouds. In this contribution we show that available observational data can be used to obtain some constraints on the radial distributions of the DM density inside the minihalos and we discuss several important points with regard to this problem. First, we combine the shape of the density distribution of HI in a typical cloud (which can be derived from the distribution of cloud numbers as a function of column density) with results from the study of Black (1981, MNRAS, 197, 553) on the physical conditions in hot photoionized Lyα clouds. For gas in hydrostatic equilibrium in a DM potential well we show that the radial distribution of the density of DM can be described analytically as a function of two parameters. One parameter is related to the slope of the distribution of cloud numbers as a function of column density. The second parameter is the ratio of the DM density in the center of a cloud to the background density of DM outside the cloud. To obtain some constraints on the second parameter we use observational results on the distribution of Doppler parameters, the variation of cloud numbers with redshift, and assumptions about how the distribution of cloud numbers varies with cloud mass. With this information we are able to derive the redshift dependence of the distribution of DM potential well parameters.

Session 115: Cosmology and Dark Matter
Oral Session, 10:15-11:45 am
Salon III

115.01

Do Dark Halos Form Too Late in a Cold+Hot Dark Matter Universe?
Chung-Pei Ma (Caltech), Edmund Bertschinger (MIT)

Replacing some of the cold dark matter (CDM) with massive neutrinos appears to be a viable way to alleviate some of the structure-formation problems found in CDM models. We investigate a cold+hot dark matter (CDM+HDM) model with Ω_cdm = 0.65, Ω_b = 0.30, Ω_m = 0.05, H0 = 50 km s⁻¹ Mpc⁻¹, and an isotropic, scale-invariant (n = 1) primordial power spectrum normalized to COBE. We report results from a high-resolution N-body simulation with ~ 2.1 million cold and ~ 21 million hot particles. The simulation is performed in a 100 Mpc comoving cube with a 50 kpc comoving Plummer force-softering distance starting at redshift z = 13.55.

Special care is taken to obtain an accurate sampling of the neutrino phase space for the HDM initial conditions. We have done this by integrating the trajectories of individual HDM particles using linearized general relativity including all relevant particle species (CDM, photons, baryons, massless neutrinos, and massive neutrinos) from z = 10⁶ (shortly after decoupling, when we sample the Fermi-Dirac distribution) to z = 13.55. The nonlinear Newtonian integration begins then and proceeds to z = 0. At several epochs we identify dark matter halos using a density-maximum (DENMAX) algorithm that finds all particles within closed contours of the smoothed density field surrounding a peak.

We examine whether the CDM+HDM model with Ω_b = 0.3 leads to the formation of too few high-redshift objects due to the suppression of small-scale power by the massive neutrinos. In our simulation volume at z = 2.3 we find that only 2 galactic-scale (<100 kpc) objects have collapsed to mean overdensity exceeding 200 with mass exceeding 10¹⁰ M⊙ at z = 4 there are none. Unless the efficiency of quasar formation is greater than previously estimated, this model cannot account for the abundance of high-redshift objects. However, small-scale power can be increased by decreasing Ω_b. It remains unclear whether, by adjusting this parameter, we may arrive at a model with sufficient power on large scales and sufficiently early galaxy formation.

115.03

Galaxy Formation on Caustics
Nick Gnedin (Princeton University Observatory)

The simple model for galaxy formation during the evolution of large-scale structure is proposed. The model is designed to separate sharply galaxy formation on peaks and on pancakes and filaments. The two-component (dark matter plus baryonic fluid) cosmological code in PM-implementation is supplemented with the gravitational instability criteria which is based on the approximate solution to the nonstationary virial equations at each particle in the simulation. The local geometry, determined according to the eigenvalues of the deformation