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POSTER ABSTRACTS

Chen, Ke-Jung	***Cosmic Impact of the First Binaries*** Volker Bromm, UT Austin USA We present the cosmological simulations of impact of the first binaries. Recent studies of the first star formation suggest that those stars tend to form into binaries or multiple stellar systems instead of single stars, so the first stars could be less massive than we originally thought. It implies the first stars would die as score collapse supernovae instead of pair-instability supernovae, both of them are very different in nucleosynthesis yields and explosion energies. We use the well-tested massively- parallel combined N-body and smoothed-particle hydrodynamics code Gadget-2, modified to include detailed cooling, chemistry, and radiative transfer of primordial gas to study the impact of the first binaries. We take realistic Pop III stellar models and their nucleosynthesis products as initial inputs for our cosmological simulations and trace the transport of supernova metals that can significantly affect the chemical enrichment in the primordial intergalactic medium. In this talk, we discuss the impact of the first binaries to the early Universe and their observational signatures for the forthcoming James Webb Space Telescope.
Iijima, Haruhisa	***Two-dimensional numerical study on the supergranular-scale magneto-convective structure near the photosphere in the solar quiet region*** Haruhisa Iijima, The University of Tokyo, Japan Takaaki Yokoyama, The University of Tokyo, Japan The Doppler velocity on the quiet solar surface have two distinct horizontal structures, i.e. granulation and supergranulation. The granulation is a smaller structure and is explained as convective cells driven by the strong photospheric radiative cooling. However, the origin of the larger supergranulation is still unclear. The latent heat of the partial ionization of helium is one of the candidates as a driver of supergranulation. The other candidate is the effect of the magnetic field. It is well-known that the magnetic concentration, called the magnetic network, is observed near the boundary of the supergranulation cells. The magnetic network is often explained as a result of the passively advected magnetic flux by the supergranular flow. However, the magnetic field strength sometimes becomes strong, possibly enough to affect the plasma motion near the solar surface. We newly develop a radiative magneto-hydrodynamic simulation code for the realistic calculation of the solar surface magneto-convection to investigate the effect of the magnetic field on the supergranular-scale convective flow. We found that, when the magnetic field strength is moderate, no distinct supergranular-scale flow appears near the photosphere. When the magnetic field becomes sufficiently strong, the magnetic network affect the supergranular convection and produce the enhancement of large-scale kinetic energy.

Kotov, Mikhail	***Experimental researches and numerical validation of shockwave processes in the shock tube*** M.A. Kotov, Institute for Problems in Mechanics RAS, Russia I.A. Kryukov, Institute for Problems in Mechanics RAS, Russia L.B. Ruleva, Institute for Problems in Mechanics RAS, Russia S.I. Solodovnikov, Institute for Problems in Mechanics RAS, Russia S.T. Surzhikov, Institute for Problems in Mechanics RAS, Russia Unsteady regimes of shock waves interactions are investigated both experimentally and numerically. Hypersonic shock aerodynamic tube is used for experimental study of non stationary interactions of shock waves at high Mach numbers. The facility was constructed to experimentally investigate a structure of aerodynamic flowfield and to monitor accompanied phenomena and features. The shock tube has piezoelectric pressure transducers that are used for registration of shock wave interaction and to trigger the data recording equipment. The shadow picture of the shock waves interactions is recorded by using the digital high-speed video camera with optical resolution enough to capture main features of the flow structure. Interactions of shock waves with Mach number of 7 and 4.5 were captured on the high-speed video camera. Shock-wave structure is generated by using selected geometric elements allocated in measuring section of hypersonic tube. This allows us to vary the model configuration, depending on what type of shock wave structure we want to observe. Important feature of the work is that the experimental results are used specifically for making the validation of numerical simulation. Also transient processes that occur during change of stationary flow regimes were observed at the facility. This allows to consider the nature of the flows at high Mach numbers more fully. In the numerical simulation we used codes intended for study of non stationary shock wave interactions. It was assumed that the flow is governed by the compressible Navier-Stokes equations which describe the conservation of mass, momentum, and energy in a viscous fluid with appropriate boundary and initial conditions. The current flow solver is a density based cell center finite volume Navier-Stokes solver and can be considered as a Godunov-type solver. The solver allows to achieve the second order of accuracy in time and space for smooth solutions using MUSCL approach and explicit Runge-Kutta method. The comparison the computed results with the experimental data shows that the numerical simulation allows obtaining the flow structure in good agreement with experimentally observed.
Nakamura, Sho	***A galactic magnetism: effects steady spiral arms*** Sho Nakamura, Tohoku University, Japan Makoto Hattori, Tohoku University, Japan We study numerically the large-scale gas and magnetic field evolution of spiral galaxies in the gravitational potential of a disc, bulge, halo, and spiral arms. We adopt a steady axisymmetric gravitational potential given by Miyamoto et al. and rigid rotating spiral potential. We carried out 3D MHD simulation taken into account radiative cooling energy loss. Our models demonstrate that the magnetic fields strength are dramatically amplified by disturbance due to gravitational potential of spiral arms and magnetic arms are generated. Numerical results indicate that the isothermal shocks generated by gravitational potential of spiral magnetic fields around the spiral arms are amplified up to a few uG about one rotation period (~200Myr) . The azimuthal direction of mean magnetic fields in the disc changes with radius due to magneto-rotational instabilities. The resultant structure of azimuthal magnetic fields distribution is also qualitatively consistent with the observed distribution of the Faraday rotation measure(RM).

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Purohit, Pramod Kumar	***Investigation of Effects of Geomagnetic Storms Produced by Different Solar Sources on the Total Electron Content (TEC)*** P. K. Purohit, Azad A. Mansoori, Parvaiz A. Khan, Purushottam Bhawre, Sharad C. Tripathi, Aslam A. M., Malik A. Waheed and A. K. Gwal The geomagnetic storm represents the most outstanding example of solar wind- magnetospheric interaction, which causes global disturbances in the geomagnetic field as well as the trigger ionospheric disturbances. We study the behaviour of ionospheric Total Electron Content (TEC) during the geomagnetic storms. For the present investigation we have selected 47 intense geomagnetic storms (Dst ≤ -100nT) that were observed during the solar cycle 23 i.e. during 1998- 2006. We then categorized these storms into four categories depending upon their solar sources like Magnetic Cloud (MC), Co-rotating Interaction Region (CIR), SH+ICME and SH+MC. We then studied the behaviour of ionospheric TEC at a mid latitude station Usuda (36.13N, 138.36E), Japan during these storm events produced by four different solar sources. During our study we found that the smooth variations in TEC are replaced by rapid fluctuations and the value of TEC is strongly enhanced during the time of these storms belonging to all the four categories. However, the greatest enhancements in TEC are produced during those geomagnetic storms which are either caused by Sheath driven Magnetic cloud (SH+MC) or Sheath driven ICME (SH+ICME). We also derived the correlation between the TEC enhancements produced during storms of each category with the minimum Dst. We found the strongest correlation exists for the SH+ICME category followed by SH+MC, MC and finally CIR. Since the most intense storms were either caused by SH+ICME or SH+MC while the least intense storms were caused by CIR, consequently the correlation was strongest with SH+ICME and SH+MC and least with CIR.
Richers, Sherwood	***Three-dimensional GRMHD Simulations of Core-Collapse Supernovae*** Sherwood Richers, Philipp Mösta, Christian Ott, Roland Haas, Anthony Piro, Kristen Boydstun, Ernazer Abdikamalov, Christian Reisswig, Erik Schnetter We present results of new three-dimensional (3-D) general-relativistic magnetohydrodynamic simulations of rapidly rotating strongly magnetized core collapse. These simulations are the first of their kind and include a microphysical finite-temperature equation of state and a leakage scheme that captures the overall energetics and lepton number exchange due to post-bounce neutrino emission. Our results show that the 3-D dynamics of magnetorotational core-collapse supernovae are fundamentally different from what was anticipated on the basis of previous simulations in axisymmetry (2-D). A strong bipolar jet that develops in a simulation constrained to 2-D is crippled by a spiral instability and fizzles in full 3-D. While multiple (magneto-)hydrodynamic instabilities may be present, our analysis suggests that the jet is disrupted by an m=1 kink instability of the ultra-strong toroidal field near the rotation axis. Instead of an axially symmetric jet, a completely new, previously unreported flow structure develops. Highly magnetized spiral plasma funnels expelled from the core push out the shock in polar regions, creating wide secularly expanding lobes. We observe no runaway explosion by the end of the full 3-D simulation 185 ms after bounce. At this time, the lobes have reached maximum radii of about 900 km.
Takafumi, Kaneko	***New Model for Solar Filament Formantion and Demonstration by MHD Simulations*** Takafumi Kaneko, The University of Tokyo, Japan Takaaki Yokoyama, The University of Tokyo, Japan We investigate the formation mechanism of solar filaments by two-dimensional magnetohydrodynamic (MHD) simulations including the nonlinear anisotropic thermal conduction and the radiative cooling. Solar filaments are cool dense plasma clouds in the hot tenuous corona. The dense plasmas are sustained by the magnetic fields. Observations show that two types of the magnetic structures of the filaments exist, one is the normal polarity filament which has same polarity with the surrounding coronal magnetic fields and the other is the inverse polarity filament which has opposite polarity. The origin of cool dense plasmas is still unclear. One candidate is the condensation by the radiative cooling in the corona. The current condensation model can reproduce the normal polarity filaments, but not the inverse polarity filaments. We propose a new condensation model to reproduce the inverse polarity filaments, and demonstrate it by two-dimensional MHD simulations including radiative cooling, thermal conduction along the magnetic field and gravity. The numerical scheme is the rational CIP-MOCCT method. The thermal conduction and the radiative cooling are solved by explicit method. In our model, the relatively dense plasmas at the lower corona are trapped inside the flux rope and levitated to the upper corona. Stronger radiative cooling of the dense plasmas cause the thermal imbalance over the background heating, while the thermal conduction along the closed field line of the flux rope does not suppress this imbalance. Consequently, the radiative condensation process is triggered and forms the cool dense plasmas at the lower part of the flux rope. We tested two types of heating term (one depends on magnetic pressure and the other depends on density) and succeeded in reproducing the inverse polarity filaments in both cases. We also show that our model has a possibility to reproduce the density of solar filaments, which is 10 -100 times larger than that of the surrounding corona.