We describe relations between modern cosmology and general relativity in the historical context. We reveal some ironies imbedded in Einstein's final correction of his gravitational field equation in the context of cosmology in 1917 which has apparently opened a new era of modern physical cosmology. The ugly (according to Einstein) correction term was introduced only to build a static cosmology which turns out to be in flat contradiction with observation. Somehow, however, it is the correction term which has saved the modern cosmology from the genuine creativity of nature continuously revealed by astronomical observations. Whether the present precision cosmology is also a correct one is often ignored by the practitioners but still a pressing open question left for future theoretical and observational pursuits.

[구 GR-03] Gravitational-wave detection - for the new age of astronomy (중력파 검출 - 새로운 천문학의 시대를 위하여)

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Gravitational-wave has been predicted by Einstein's general relativity in 1916, but its direct detection has failed to date despite of the persistent efforts in the last fifty years in the ground-based gravitational wave detectors. In the centennial year of the birth of general relativity, 'advanced LIGO', one of the most promising Earth-based gravitational wave detectors, plans to start commissioning for the successful discovery of gravitational waves. In addition, a pathfinder satellite of eLISA project, a space-based GW antenna by European Space Agency (ESA), will be launched in the mid of this year. In this talk, we review the current status of gravitational waves detection experiments and discuss its scientific impacts and the possibility of opening the new age of astronomy.

성간물질 / 우리은하

[구 IM-01] MHD Turbulence in Expanding and Contracting Media

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We investigate the decaying incompressible MHD turbulence by including the effect of the expansion and contraction of background medium. In such an environment, incompressible MHD turbulence has two kinds of time scale. One is the eddy turn-over time (teddy), the other is the expansion/contraction time (texp-cntr). The turbulence is expected to behave differently according to the relationship between the two time scales. For instance, for teddy < texp-cntr, the turbulence would be decay more or less as in a static medium. On the other hand, for teddy > texp-cntr, the effects of expansion and contraction would be dominant. We examine the properties of turbulence in these two regime cases. Based on it, we derive a scaling for the time evolution of flow velocity and magnetic field. (i) In the decay effect dominant case, the velocity and magnetic field scale as $\sqrt{\rho}\,\mathrm{v} \sim \mathrm{a}^{-3}$, $\mathrm{b} \sim \mathrm{a}^{-2.5}$ (expanding media) and $\sqrt{\rho}\,\mathrm{v} \sim \mathrm{a}^{-2}$, $\mathrm{b} \sim \mathrm{a}^{-1.5}$ (contracting media). The total energy and residual spectra follow the $E_k^{\mathrm{T}} \sim k^{-5/3}$, $E_k^{\mathrm{R}} \sim k^{-7/3}$ in the inertial range. (ii) In the expanding and contracting dominant case, the velocity and magnetic field scale as $\sqrt{\rho}\,\mathrm{v} \sim \mathrm{a}^{-2.5}$, $\mathrm{b} \sim \mathrm{a}^{-2}$ (expanding/contracting media). The Kinetic and magnetic energy spectra follow the $E_k^{\mathrm{K}} \sim a^{-5}$, $E_k^{\mathrm{M}} \sim a^{-4}$. We have confirmed that scaling of velocity and magnetic filed is almost the same from the analytic estimates and computational models.

[구 IM-02] Expansion of Dusty H II Regions and Its Impact on Disruption of Molecular Clouds

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Dynamical expansion of H II regions plays a key role in dispersing surrounding gas and therefore in limiting the efficiency of star formation in molecular clouds. We use analytic methods and numerical simulations to explore expansions of spherical dusty H II regions, taking into account the effects of direct radiation pressure, gas pressure, and total gravity of the gas and stars. Simulations show that the structure of the ionized zone closely follows Draine (2011)'s static equilibrium model in which radiation pressure acting on gas and dust grains balances the gas pressure gradient. Strong radiation pressure