통해 한국은 후발국과 선진국 사이의 중간자적인 입장임을 밝혔고, 한국 천문학을 선진국 수준으로 발전시키기 위한 투자 규모를 정량적 수치로 제공한다.

[구 EN-05] A Fast Poisson Solver of Second-Order Accuracy for Isolated Systems in Three-Dimensional Cartesian and Cylindrical Coordinates

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We present an accurate and efficient method to calculate the gravitational potential of an isolated system in three-dimensional Cartesian and cylindrical coordinates subject to vacuum (open) boundary conditions. Our method consists of two parts: an interior solver and a boundary solver. The interior solver adopts an eigenfunction expansion method together with a tridiagonal matrix solver to solve the Poisson equation subject to the zero boundary condition. The boundary solver employs James's method to calculate the boundary potential due to the screening charges required to keep the zero boundary condition for the interior solver. A full computation of gravitational potential requires running the interior solver twice and the boundary solver once. We develop a method to compute the discrete Green's function in cylindrical coordinates, which is an integral part of the James algorithm to maintain second-order accuracy. We implement our method in the {\tt Athena++} magnetohydrodynamics code, and perform various tests to check that our solver is second-order accurate and exhibits good parallel performance.

[구 EN-06] Deep Learning Model on Gravitational Waves of Merger and Ringdown in Coalescence of Binary Black Holes

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We propose a deep learning model that can generate a waveform of coalescing binary black holes in merging and ring-down phases in less than one second with a graphics processing unit (GPU) as an approximant of gravitational waveforms. Up to date, numerical relativity has been accepted as the most adequate tool for the accurate prediction of merger phase of waveform, but it is known that it typically requires huge amount of computational costs. We present our method can generate the waveform with ~98% matching to that of the status-of-the-art waveform approximant, effective-one-body model calibrated to numerical relativity simulation and the time for the generation of ~1500 waveforms takes O(1) seconds. The validity of our model is also tested through the recovery of signal-to-noise ratio and the recovery of waveform parameters by injecting the generated waveforms into a public open noise data produced by LIGO. Our model is readily extendable to incorporate additional physics such as higher harmonics modes of the ring-down phase and eccentric encounters, since it only requires sufficient number of training data from numerical relativity simulations.

항성 및 항성계

[박 SA-01] Atomic Raman Spectroscopy of Wind Accretion in Symbiotic Stars

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We present our observational and theoretical investigation of Raman-scattered features in symbiotic stars (SySts). SySts are long interacting binaries, consisting of a hot compact star and an evolved giant, whose interaction via accretion process is at the origin of a tangled network of gas and dust nebulae. These systems are ideal objects to study a variety of important astrophysical problems, and have also been proposed as possible progenitors of type Ia supernova. In this talk, we emphasize that Raman-scattered features are exclusive spectroscopic tools to probe the stellar wind accretion processes in SySts. We studied mass transfer and mass loss processes in SySts using high resolution spectra obtained with 1.8m telescope at Mt. Bohyun and the 6.5m Magellan-Clay telescope combining with the theoretical modeling of radiative transfer of Raman-scattered features. We also note that there are a much smaller number of SySts known in our Galaxy, implying the necessity of systematic search programs. In view of the fact that Raman O VI features at 6830Å are found in only bona fide SySts, we will carry out a photometric search of objects with Raman O VI features using a narrow band filter centered at 6830Å in Local group galaxies.