bulge is older than that in the halo by 1.3±0.3 Gyr. Other possibilities can be ruled out from the analyses of the periods of RR Lyrae variables and/or other observations. Implications of this result on the formation of the Galaxy and on the age of the Universe will be discussed.

Instabilities in Cosmic Ray Dominated Shocks

Hyesung Kang[1], Dongsu Ryu[2], and T. W. Jones[3]
[1]Department of Earth Sciences, Pusan National University
[2]Department of Astroomy and Space Sciences, Chungnam National University
[3]School of Physics and Astronomy, University of Minnesota, U.S.A.

Previous studies have shown that small compressional disturbances propagating into a cosmic-ray (CR) dominated medium can be amplified by a 1D acoustic instability. If the wavelength of the disturbances is shorter than the CR pressure scale height, and if the CR pressure scale height is shorter than the diffusion length associated with sonic flow, disturbances travelling in the direction of increasing CR pressure can grow, while those travelling in the direction of decreasing CR pressure can be damped out. Here we report that, as a consequence of the 1D acoustic instability, a Rayleigh-Taylor type instability can develop in 2D flow, when the flow is perturbed along the direction parallel to the shock front. In addition to the sound waves propagating along the shock normal. Using the local WKB approximation the growth rate of the secondary instability is shown to be comparable to that of the 1D acoustic instability itself in the cases we have considered. The nonlinear development has been followed numerically with a 2D PPM hydrodynamics code that also incorporates the two-fluid CR energy equation. We show that the secondary instability may cause the precursor and post shock flows to become highly turbulent. However, neither the primary, 1D acoustic instability nor the secondary instability has a significant effect on the cosmic-ray pressure around the shock. That is because CR diffusion through the perturbations is much faster than the growth rate of the instability.

Dynamical Evolution of SNR VRO 42.05.01

S.-U. Choe[1] and Bon-Chul Koo[2]
[1]Department of Earth Science Education, Seoul National University
[2]Department of Astronomy, Seoul National University

We have numerically simulated the evolution of SNR VRO 42.05.01 (G166.0+4.3) in order to understand the dynamical interaction of the SNR with the surrounding ISM. Radio

(Pinault et al, 1987) and ROSAT (Guo and Burrows, 1993) observations suggest that the unusual morphology of VRO 42.05.01 is caused by a SN blast wave breaking out of the cloud where the SN event occurred, and expanding into another cloud across a much less dense and, presumably, hot cavity. Our numerical results are consistent with the interpretation of a passing SN blast wave across the cavity. We discuss the implications of our results on the dynamics of VRO 42.05.01 such as the breaking of the shell due to the Rayleigh-Taylor instability, the reverse shock formed by a reflection, and the rejuvenation of the cavity.

OBSERVATIONS OF C_3H_2 (2_{12} - 1_{01}) TOWARD THE SAGITTARIUS A MOLECULAR CLOUD

Chang Won Lee[1], Young Chul Minh[2] , and W. M. Irvine[3]

[1]Department of Earth Science, Pusan National University

[2]Daeduk Radio Astronomy Observatory, KAO

[3]Five College Astronomy Observatory; and Department of Physics and Astronomy, University of Massachusetts, Amherst, MA 01003, U.S.A.

We mapped the C_3H_2 2_{12} - 1_{01} transition line toward the Sgr A molecular cloud on a 1′ grid spacing. We derive C_3H_2 column densities of $\sim 10^{15}cm^{-2}$ for several clouds of the Sgr A. The fractional abundance of C_3H_2 relative to H_2 are obtained to be $1.5 \sim 3.5 \times 10^{-8}$, which are comparable to that for the cold dark cloud TMC-1. We also estimate masses of $\sim 10^5 M_\odot$ by using total C_3H_2 masses and the abundance of C_3H_2 for two clouds(M-0.13-0.08, M-0.02-0.07). From comparison of these with masses by virial theorem, it is suggested that one of two clouds(the M-0.02-0.07) may be in expansion state. The H_2 densities of $\sim 10^3 cm^{-3}$ at the cores of these clouds are obtained. We suggest that the enhanced abundance of Sgr A may be accomplished from a modified ion-molecule reaction after the passage of non-dissociating shocks, not from a quiescent ion-molecule reaction.

S140의 분자함량과 운동학적 특성

박 용 선 민 영 철

대덕전파천문대, KAO

수소전리영역 S140과 연관되어 있는 것으로 보이는 분자운에 대하여 FCRAO이 14M 전파망원경과 촛점면 어레이(QUARRY) 수신기를 이용하여 10개의 밀리미터파 분자선, $^{12}CO(1-0)$, $^{13}CO(1-0)$, $C^{18}O(1-0)$, CS(2-1), $HCO^+(1-0)$, HCN(1-0), SO(2-1), $SO_2(2_{20}-3_{13})$, OCS(8-7), 및 $HNCO(4_{04}-3_{03})$를 50″분해능으로 관측하였다. 관측영역은 33′x40′(총1900 여점)으로 이 지역에