by the bow shock and cocoon both parallel and perpendicular to the jet axis, (2) the time dependence of the source volume, and the variation of pressure with source size, and (3) the overall shape and aspect ratio of the cocoon and bow shock. We compare the predictions of our improved analytical model with the numerical simulations over the same broad range of parameter space and find that they are generally in good agreement, especially at high Mach number which the effects of turbulence and instabilities in the cocoon are reduced in the simulations. We also compare our improved analytical model with the self-similar models. In general, the behavior of the analytic model (i.e., the exponents of the main scaling laws) depends on both the source size and the Lorentz factor. In the case of a constant density atmosphere, there is somewhat better agreement with the predictions of the Type I (jet advancing with constant speed) self-similar models. On the other hand, in the case of a declining density atmosphere, there is somewhat better agreement with the predictions of the Type III (jet advances keeping a constant head to cocoon pressure ratio) self-similar models.

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## SUPERNOVA EFFICIENCY IN HEATING THE INTERSTELLAR MEDIUM OF STARBURST GALAXIES

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The interstellar medium heated by supernova explosions (SN) may acquire an expansion velocity larger than the escape velocity and leave the galaxy through a supersonic wind. Galactic winds are effectively observed in many local starburst galaxies. SN ejecta are transported out of the galaxies by such winds which thus affect the chemical evolution of the galaxies. The effectiveness of the processes mentioned above depends on the heating efficiency (HE) of the SNs. In a starburst region several SN explosions occur at high rate inside a relatively small volume. A superbubble of high temperature and low density takes place, and in this environment the successive generations of SNRs do not reach high density during their expansion, their radiative losses remain negligible and it is common to assume a value of HE close to unity. But this assumption fails in reproducing both the chemical and dynamical characteristics of starburst galaxy. In order to solve this problem, we have constructed a simple semi-analytic model able to give us insights on the thermalisation of the ISM inside a starburst region. The most important physical phenomena are studied, assuming a three-phase medium composed by hot gas, SNR and clouds. The most important result is a very low SN efficiency value in the first 10 Myrs, which gets closer to 1 only after about 15-20 Myrs. On the whole, we can conclude that the HE has a depending-time trend as it results from initial conditions and parameter assumptions. This model allows to scale down typical HE values and explains the low values assumed in some chemical models (D'Ercole & Melioli, MNRAS, 2002). Presently, we are implementing a 3D, gasdynamical code aiming to check the SN HE estimates obtained from the analytical model above, by including all the SB environment contents and fully solving the chemo-dynamical equations of the three-phase system.



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## FP-LIKE RELATIONS FROM COLLISIONLESS STELLAR DYNAMICS

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We report on new results of numerical simulations aimed to understand the structure of elliptical galaxies and the origin of the correlation embodied in the Fundamental Plane. In a previous work (Capelato, de Carvalho & Carlberg 1995, ApJ, 451, 525) we have shown that dissipationless, one-component *merger simulations* could reproduce entirely the "Fundamental Plane" (FP) of elliptical galaxies. Subsequent numerical investigations by Dantas et al. (2002, A&A, 384, 772) showed that, as opposed to mergers, one-component, equal mass *collapses* of several different initial models and collapse factors do *not* retrieve a FP-like relation. In continuity to these investigations, we extended the hierarchical merger scheme by using a different initial grid of one-component models which follow a Hernquist-type profile. We also investigate two-component Hernquist models in order to better understand the effect of the presence of a massive dark halo on our results. We find that the one-component Hernquist mergers also reproduce a FP-like relation, in agreement with the results of Capelato et al., implying that the effect is model independent. The two-component mergers reproduce a FP-like relation with a steeper tilt than that of one-component models. We discuss the origin of the Fundamental Plane in the light of the dynamical processes occurring during the merger.