Curriculum Vitae

Raffaella Schneider
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Education:
PhD degree at the Physics Department of the University of Rome "La Sapienza". Title: *"Stochastic backgrounds of gravitational waves from cosmological populations of astrophysical sources"* (2000)
Laurea Degree at the Physics Department of the University of Rome "La Sapienza". Title: *"Anisotropies of the Cosmic Microwave Background Radiation: an analytic approach to the problem of the large scale structure"* (1995)

Positions:
Permanent Research Position at INAF – Osservatorio Astrofisico di Arcetri, Florence, Italy (since 30/12/2005)
Postdoc position at the Excellence Center "Enrico Fermi", Rome, Italy (2003-2005)
Posdoc position at INAF - Osservatorio Astrofisico di Arcetri, Florence, Italy (2000-2002)

External Appointments:
Visiting scientist, Dark Cosmology Center, Copenhagen (July 2009)
Visiting scientist, National Astronomical Observatory of Japan, Mitaka (January 2009)
Visiting scientist, Max Planck Insitute for Astrophysics, (November 2008)
Visiting scientist, Dark Cosmology Center, Copenhagen (July 2008)
Visiting scientist, Institute for Nuclear Physics, Seattle (July 2006)
Visiting scientist, Kavli Institute for Theoretical Physics, Santa Barbara (November 2004)
Visiting fellow, Niels Bohr Institute, Copenhagen (1994-1995)

Professional experience:
More than 30 contributed talks e 20 invited talks in international conferences since the PhD Degree (2000)
Member of the DAVID – Dark Ages Virtual Department http://www.arcetri.astro.it/twiki/bin/view/DAVID/WebHome (since 2005)
Peer reviewer for Monthly Notices of the Royal Astronomical Society, The Astrophysical Journal, Astronomy & Astrophysics, Classical and Quantum Gravity (since 2000)
SOC member of 10 internazional conferences (since 2001)
LOC member of 4 international conferences (since 2001)

Current research interests:

The origin and evolution of high-redshift dust

In the last few years mm and submm observations of high redshift quasars and galaxies have provided a powerful way of probing the very existence and properties of dust within 1 Gyr of the Big Bang. It is generally believed that at these cosmic times dust could have only condensed in the explosive ejecta of supernovae since intermediate-to-low mass stars did not have time to evolve off the main sequence into the dust-condensation stage. To account for the dust masses observed at $z > 6$, about 1 M_{sun} of dust per supernova needs to be produced, in agreement with the condensation efficiencies predicted by supernova dust nucleation models. However, the largest dust masses measured so far in supernova ejecta are about two orders of magnitude smaller.
Conversely, indications for supernova dust beyond $z \sim 6$ have recently come from observations of dust reddening of the host galaxies of a $z = 6.2$ quasars and $z = 6.3$ gamma-ray burst. In the last few years, we have developed models for dust production in supernova ejecta discussing the role of some critical parameters which affect the resulting dust yield. We have also developed chemical evolution models which also take into account the effect of intermediate mass stars and the subsequent evolution of dust in the interstellar medium of high redshift galaxies.

The Population III/II transition

Physical conditions in primordial star forming regions systematically favor the formation of very massive stars. This is due to the combined effect of the larger fragmentation scale and accretion rate, and the very limited opacity. On the other hand, observations of present-day stellar populations (Pop II/I stars) show that stars form with a Salpeter-like IMF and with a characteristic mass of ~ 1 M_{sun}. Thus, unless the current picture of primordial star formation is lacking in some fundamental ingredient, a transition between these two modes of star formation must have occurred at some time during cosmic evolution. Following a number of detailed studies, the emerging physical scenario suggests that the fragmentation properties of the collapsing gas clouds change as the mean metallicity of the gas increases above a critical threshold:
10^{-6} $Z_{sun} < Z_{cr} < 10^{-4}$ Z_{sun}, where the lower limit applies when a fraction of metals in condensed in dust grains and the upper limit applies when only gas-phase metals are present. According to this view, the formation of Pop III stars (defined as those with $Z < Z_{cr}$) is regulated by the rate at which heavy elements are produced and mixed in the gas surrounding the first star formation sites, the so-called chemical feedback.
We have developed semi-analytic and numerical models which attempt to describe chemical feedback and the Pop III – II transition on cosmic scales and its consequence for the reionization history. We have explored the implications of those models for the observability of Pop III stars through direct detection at moderate redshifts or through the identification of their peculiar nucleosynthetic signatures in local samples of metal-poor stars.

Stochastic backgrounds of gravitational waves from extragalactic sources

Gravitational waves of cosmological origin could be the result of a large variety of astrophysical and cosmological processes that develop in the very early Universe. As a consequence, the high redshift Universe is expected to be permeated with a background of gravitational radiation. Depending on their origin, these stochastic gravitational wave backgrounds will show different spectral properties and features that it is important to investigate in view of a possible, future detection. Over the years, we have made theoretical predictions for backgrounds produced by different classes of extragalactic sources and discuss their detectability with current and future gravitational wave observatories.

Publication list:
59 scientific publications, 37 in international refereed journals, among which: Montly Notices of the Royal Astronomical Society (25), The Astrophysical Journal (7), Nature (2), New Astronomy (1).
Full publication list at: http://www.arcetri.astro.it/~raffa/publications.html

Outreach activity:
Member of the Associazione Astronomica Amici di Arcetri (since 2009)
Partecipation to outreach activities of the Osservatorio Astrofisico di Arcetri (since 2001).
Public lectures at the Planetarium in Florence and in different secondary schools and public institutions within the science outreach program "Pianeta Galileo" (since 2005).