EDITORIAL

Bobomurat Ahmedov · Ashfaque H. Bokhari

Preface

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The Arabian Journal of Mathematics (AJM) publishes original research articles covering all branches of Pure and Applied Mathematics and Mathematical Physics. More recently, the journal has been receiving articles in fields such as Differential and Riemannian Geometry and Classical Relativity. On the other hand, recent detection of gravitational waves from the coalescence of gravitational objects in close black hole and neutron star binaries by LIGO–VIRGO scientific collaboration, confirmation of black hole status of the Milky Way center by ESO’s GRAVITY instrument and upcoming first detection of the black hole shadow in M87 and Sagittarius A* by the Event Horizon Telescope lead to the rapidly growing interest in the study of relativistic astrophysical objects. In the light of these recent successes of general theory of relativity, AJM decided to further widen its scope by opening it to researchers working in areas such as Mathematical Physics, General Relativity, and Relativistic Astrophysics. It is in this spirit that AJM is publishing two special issues on Mathematical Physics, General Relativity and Relativistic Astrophysics.

Well-known scientists working in the aforementioned areas were invited to write research or review articles. Of these invited scientists, five accepted the invitation to contribute to the first issue focussing mainly on Mathematical Physics and General Relativity and five accepted to contribute to the second issue with more emphasis on Relativistic Astrophysics.

A brief overview of the five articles appearing in the first issue is as follows. The first article by Dutt, Safdar and Qadir is entitled “Linearization procedure for 2-dimensional systems of second order ODEs using complex Lie symmetry analysis”. The authors discuss an interesting linearization procedure and, using a complex Lie symmetry approach, obtain a linearizable form, linearization criteria, and a symmetry group classification for the two-dimensional system. The second paper entitled “Some remarks on wave solutions in general relativity theory” is contributed by Hall. In this article, the author exposes an excellent overview of one of the outstanding concepts of pp-waves and plane waves in classical relativity. Beginning with a discussion of some algebraic constructions and symmetry concepts, Hall deals with definitions of such wave solutions, their associated geometrical tensors in space-time and their Killing, homothetic, conformal and wave surface symmetries. The paper concludes with some unusual geometrical features of these solutions (compared with standard positive definite geometry). The third paper entitled “QED plasma in the early universe” is contributed by Masood. In this paper, the author considers a renormalization scheme of QED by showing that the dielectric constant,

B. Ahmedov
Ulugh Beg Astronomical Institute, Astronomicheskaya 33, Tashkent 100052, Uzbekistan
E-mail: ahmedov@astrin.uz

B. Ahmedov
National University of Uzbekistan, Tashkent 100174, Uzbekistan

A. H. Bokhari (✉)
Department of Mathematics and Statistics, King Fahd University of Petroleum and Minerals, Dhahran 31261, Saudi Arabia
E-mail: abokhari@kfupm.edu.sa

magnetic-reluctivity, Debye length and the plasma frequency depend on temperature in the early universe. Computing propagation speed, refractive index, plasma frequency and Debye shielding length of a QED plasma at extremely high temperatures in the early universe, certain favorable conditions for the relativistic plasma are obtained. The fourth contribution is by Tahir et al. entitled “Seeing the halo rotation of nearby spiral galaxies using Planck data”. In this paper, the authors deal with rotation of the galactic halos as being one of the fascinating topics to be addressed. Whereas the *Planck* data show the existence of a temperature asymmetry towards the halo of several nearby galaxies, such as M31, NGC 5128, M33, M81 and M82, the cause of this asymmetry is an open problem. A possible way to explain the observed effect depends on the presence of “cold gas clouds” populating the galactic halos, which may be the answer to the so-called missing baryon problem. The authors present a technique to estimate an upper limit to the rotational velocity of the halo of some nearby spiral galaxies using both their dynamical masses and the *Planck* data.

The last article in this issue is contributed by Tsamparlis and Paliathansis on “The generic model of general relativity”. This is an interesting article which develops a generic space-time model. The model uses two types of assumptions, geometric assumption and assumptions defining a class of observers by means of their 4-velocity. The first assumption concerns symmetry notions, which act as constraints on both the kinematical and the dynamical variables of the model. The second assumption introduces the $1 + 3$ decomposition of tensor fields in space-time, which in result, defines the kinematic variables of the model, such as expansion, rotation, shear and 4-acceleration, and the kinematics of the gravitational model. The authors also discuss the $1 + 1 + 2$ decomposition of tensor fields which leads to an extended kinematics concerning both fields building the double congruence and to a finer dynamics involving more physical variables. Lastly, authors also show how their results are applied practically by considering the case of a string fluid in Bianchi I space-time for the comoving observers.

The Arabian Journal of Mathematics thanks all authors who accepted our invitation to submit their research to this first special issue. The editors particularly thank Hall, Masood, Qadir, Tsamparlis, and De-Paolis, for their valuable contributions.

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