efficiencies with commercially acceptable stabilities have been a challenge for over the years. [5]. In recent
decades, the evolution of PV cell technologies on single crystalline silicon had been starting from Aluminium
Back Surface Field (Al-BSF), continuing as Passivated Emitter and Rear Contact (PERC), Passivated Emitter Rear
Totally-Diffused (PERT), Tunnel Oxide Passivated Contact (TOPCon), Heterojunction Technology (HJT),
Interdigitated Back Contact (IBC), Heterojunction Back Contact (HBC), Metal-wrap through (MWT), Tunnelling
Oxide Passivated Back Contact (TBC). Although each technology has its own manufacturing, stability and
commercial strengths and weaknesses [6,7].
This review discusses the technological differences in the front runner silicon photovoltaic cells and makes an
attempt to foresee a direction of the race in short-term, mid-term and long-term utilizing the available data
and reviews in 2025.

**Poster Session 4** / **44**

## The contribution Hans Adolph Buchdahl f(R) gravity

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Abstract. Hans Adolph Buchdahl was born in Mainz in German in a Jewish family. He was Australian Physicist and he was born 7 July 1919 and died 7 January 2010. He worked on general relativity, thermodynamics and optics. He was the founder of the modified theory of gravity of the f(R) type, where f(R) is general functions of Ricci scalar, unlike Einstain's general theory of relativity f(R)=R. He proposed f(R) gravity first in in his paper 1970 [1]. He set up the field equations of f(R) gravity. Also he is known for developing Buchdahl's theorem which is an relation between the mass and radius in the static, spherically symmetric matter configurations.
This paper will present his historical work on the creation of f(R) gravity as the founder of f(R) gravity, and also in one chapter it will be represented Buchdahl's theorem.

[1] H. A. Buchdahl: Non linear langragians and cosmological theory. MNRAS 150 (1970),1(8).

**Condensed Matter, Materials and Applied Physics** / **45**

## Quantum dynamics of phonon-limited charge and energy transport: Numerically exact and approximate approaches*

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Recent interest in quantum dynamics of electronic excitations in molecular semiconductors and photosynthetic molecular aggregates [1] is motivated by the prospect of optoelectronic applications that could harness quantum effects and enhance charge and energy transport. Typically, the coupling of charges or excitons to quantum lattice vibrations lies in the intermediate regime, whose reasonable description necessitates computationally expensive numerically exact approaches. Meanwhile, coupled electronic–vibrational dynamics occurring on a wide range of timescales is inaccessible to most existing methods, suggesting a need for new (approximate) approaches.
In this talk, I give a synthetic overview of my recent methodological breakthroughs [2–4] concerning electronic quantum dynamics in the field of phonons.
I present the applications of the numerically exact hierarchical equations of motion (HEOM) method to the Holstein [2] and Peierls models [3]. I discuss how to overcome the method's numerical instabilities stemming from strong non-Markovian effects [2] and handle the phonon-assisted current in the Peierls model [3]. These developments enable us to answer long-standing questions such as the importance of vertex corrections to conductivity in the Holstein model [2] or the appropriateness of the transient localization scenario for charge transport in the Peierls model [3]. Finally, I show how the synergy between the theory of open quantum systems and diagrammatics of condensed matter physics can be used to devise an approximate approach to exciton dynamics in multichromophoric aggregates [4]. I discuss the application to laser-triggered exciton dynamics the Fenna–Matthews–Olson complex immersed in a realistic structured bosonic environment.

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*This research is supported by the Science Fund of the Republic of Serbia (Grant No. 5468—PolMoReMa) and Serbian Ministry of Science.

**Atomic, Molecular and Optical Physics / 46**

## An annual dataset of atmospheric 7Be and 210Pb measurements in air concentration

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7Be and 210Pb air concentrations were measured by gamma spectrometer with a High Purity Germanium detector (HPGe). The data obtained on activity concentration for both radionuclides provide key information on the origins and movements of air masses. A routine air radioactivity monitoring has started since 2021 in a typical aerosol sampling station, ASS -500, located at the Institute of Applied Nuclear Physics in Tirana, Albania. For this paper, the activity concentration of 7Be and 210Pb in ground level air during last year, from January 2024 to December 2024, was considered. We are under working with data processing to see the variation of radionuclides during these five years. The cylinder geometry efficiency curve generated by Canberra's Laboratory Sourceless Calibration Software (LabSOCS) was used to analyze the air filters. The obtained results show the activity concentrations of cosmogenic 7Be ranged from 1.19 to 5.95 mBq m–3 with a maximum in the summer