Prof. Dr. Reinhard Schlickeiser
Institute for Theoretical Physics IV, Ruhr-Universität Bochum
Universitätsstr. 150
D-44780 Bochum, Germany

rsch@tp4.rub.de

Modelling Pandemics, Mathematics of Pandemics in a Nutshell

The worldwide Covid-19 corona pandemic outbreaks during the last 4 years have revived the interest in mathematical models for forecasting the temporal evolution of the outbreaks. Very popular are compartments (or drawer) models including the susceptible infectiousrecovered/removed (SIR)- and the SIRV-models.
The SIR model, known since 1927, divides persons in a population into the three drawers S; I; R: S denotes the percentage of infectious persons, I the percentage of infected persons, and R the percentage of recovered/or deceased persons. The generally time- dependent infection rate a(t) and the recovery rate u(t) determine the transition rates between the drawers S ! I and I ! R, respectively.
With the vaccination against Covid-19 now available, the SIR epidemic model is extended to a fourth compartment, V, of vaccinated persons, which involves the time dependent effective vaccination rate, v(t) regulating the transition S ! V between susceptible and vaccinated persons.
In the talk new analytical solutions of the SIR- and SIRV-models for forecasting are described which allow us precise predictions of the course of corona outbreaks by different Covid- 19 mutants such as maximum hospitalization and mortality rates. Moreover, past mutant waves can be used to determine key pandemic parameters of the SIR and SIRV models.

CV

Education
Habilitation in Theoretical Physics and Astrophysics, Christian-Albrechts-University Kiel, 1981
PhD, Christian-Albrechts-University Kiel 1978
Diploma in Physics, Christian-Albrechts-University Kiel, 1975
Positions held:
Professor emeritus, Ruhr-University Bochum, 2021-
Senior Professor, Ruhr-University Bochum, 2018-2021
Full Professor, Ruhr-University Bochum, 1998-2018
Research Associate, Max-Planck-Institut für Radioastronomie, Bonn, 1980-1998
Adjunct Professor, University Bonn, 1994-1998
Dozent, University Bonn, 1982-1994

Research Associate, University Kiel, 1975-1980
Research Associate und NATO-Fellow, Enrico Fermi Institute, University of Chicago, 1979

Awards:
1979 NATO Postdoctoral Fellowship
1982 Deutsche Forschungsgemeinschaft Postdoctoral Fellowship
1987 High Altitude Observatory Visiting Scientist Award
2006 Co-Winner with H.E.S.S. Collaboration of the EU Descartes Research Prize
2010 Co-Winner with H.E.S.S. Collaboration of the 2010 Rossi Prize of the High Energy Astrophysics Division of
the American Astronomical Society
2022 Best Paper Prize winner of Journal of Physics A: Mathematical and Theoretical

Foreign stays:
1979 Enrico Fermi Institute, University of Chicago, USA
1981 Institute of Astronomy, University of Cambridge, UK
1984 Institute of Astronomy, University of Cambridge, UK
1987 High Altitude Observatory, Boulder, USA
2003 University of California, Riverside, USA