



## Mohamed H.A. Hassan



**Date of Birth** 21 November 1947

**Place** Elgetina, Sudan

**Nomination** 29 May 2018

**Field** Mathematics

**Title** Professor of Mathematics, Khartoum University; President, Sudanese National Academy of Sciences (SNAS)

### Most important awards, prizes and academies

Professor Hassan is the President, Sudanese National Academy of Sciences (SNAS), Chairman, Board of Trustees, Almachriq University (Sudan), Chairman, Governing Council, United Nations Technology Bank for Least Developed Countries, and Chairman of the International Advisory Board of the Centre for International Development (ZEF), Germany. His previous positions include: Co-Chair, IAP – The Global Network of Science Academies (2011-15); Chairman of the Council of the United Nations University (2012-15); Executive Director, The Academy of Sciences for the Developing World (TWAS) [formerly the Third World Academy of Sciences (from 1985)]. He is a member of the following Academies: Founding Fellow of the African Academy of Sciences (from 1985); Fellow of the Islamic World Academy of Sciences (from 1992); Hon. Member, Academia Colombiana de Ciencias Exactas, Físicas y Naturales (from 1996); Corresponding Member, Académie Royale des Sciences d'Outre-Mer, Belgium (from 2001); Foreign Fellow, Pakistan Academy of Sciences (from 2002); Foreign Member, Cuban Academy of Sciences (2008); Foreign Member, Academy of Sciences of South Africa (2010). Hassan has received the following honours (citations, awards, etc.): Comendador, Ordem Nacional do Mérito Científico, Brazil (1996); Cavaliere Ufficiale dell'Ordine al Merito della Repubblica Italiana, Italy (2003); Classe da Graça-Cruz na Ordem Nacional do Mérito Científico (from 2005); G77 Leadership Award (2007); Abdus Salam Medal for Science and Technology (2012) [World Academy of Sciences] (1983-2011); President, African Academy of Sciences (AAS) (2000-11); President, Network of African Science Academies (NASAC) (2001-11); Chairman, Honorary Presidential Advisory Council for Science and Technology (appointed by the President of Nigeria) (2001-09); Chairman, Advisory Board of the United Nations University/Institute of Natural Resources in Africa (UNU/INRA) (2003-10); Chairman, Coordinating Council of the Commission on Science and Technology for Sustainable Development in the South (COMSATS) (1995-2010).

### Summary of scientific research

Contribution to Theoretical Plasma Physics: 1. Derivation of a generalized kinetic equation for multi-species plasma in an external magnetic field. Using mathematical techniques, the equation is reduced to a form that greatly facilitated various calculations based on it. 2. Simplified forms of the equation are used in several studies in laboratory plasma experiments, including the study of temperature relaxation and distribution functions of plasma particles in fusion experiments.

Contribution to Environmental Science, Geoscience and Space Science: 1. Development of mathematical and physical models to understand the movement and impact of wind blown soil particles and the resulting formations of complex surface features in deserts. 2. Development of mathematical models to improve our understanding of the initiation and transport of dust and industrial particulate matter. 3. Studying mathematical models for fuller understanding of the discovered high degree of correlation between the variable parts of the Earth gravitational and magnetic fields. 4. Formulating and studying mathematical models for interplanetary gas and cometary dust leading to deeper understanding of their evolution.

### Main publications

Selected Scientific Publications in International Journals: Derivation of the Kinetic Equation for a Uniform Magnetized Plasma, *Plasma Physics* 19, 237 (1977) (with C.J.H. Watson); Fokker-Planck Coefficients for a Uniform Magnetized Plasma, *Plasma Physics* 19, 672 (1977) (with C.J.H. Watson); An Isotropic Temperature Relaxation of Plasma in an External Magnetic Field, *Plasma Physics* 19, 1043 (1977); Generalized Rosenbluth Potentials, *Physica* 90A, 351 (1978); Stochastic and Dynamic Temperature Changes in the Interplanetary Gas, *Planetary and Space Science* 26, 111 (1978) (with M.K. Wallis); Generalized Magnetic Rosenbluth Potentials, *Physica* 93A, 287 (1978); On the effects of a Bumpy Core-Mantel Interface, *Physics of the Earth and Planetary Interiors* 19, 239 (1979) (with I.A. Eltayeb); Non-linear Evolution of Sand Dunes, *Geophysical Journal Royal Astronomical Society* 65, 31 (1981) (with I.A. Eltayeb); The Stability and Propagation of Sand Ripples and Dunes, *Proceedings of the International Workshop on "Physics of Desertification"*, ICTP, Trieste, Martinus Nijhoff Publishers (1985) (with I.A. Eltayeb); Plasma Kinetic Equations, *Modern Plasma Physics*, International Atomic Energy Agency, Vienna, 47-83 (1981); On the Topographic Coupling at the Core-Mantel Interface, *Physics of the Earth and Planetary Interiors* 28, 14 (1982) (with I.A. Eltayeb); Electrodynamics of Cometary Dust Grains, *Cometary Exploration*, Vol. 2, Hungarian Academy of Sciences Publ., Budapest, 57 (1982) (with M.K. Wallis); Magnetic and Temperature Effects on the Energy Loss Rate of Test Ions, *J. Plasma Phys.* 29, 131 (1983) (with P.H. Sakanaka); Stochastic Diffusion in Inverse Square Fields: General Formulation for Interplanetary Gas, *Planet. Space Sci.* 31, 1 (1983) (with M.K. Wallis); Electrodynamics of Submicron Dust in the Cometary Coma, *Astron. Astrophys.* 121, 10 (1983) (with M.K. Wallis); Stochastic Diffusion of Dust Grains by the Interplanetary Magnetic Field, *Proceedings of the Spring College on Radiations in Plasma*, ICTP, Trieste (1983) (with M.K. Wallis); Sand Transport and Desertification in Arid Lands, *Fundamental Studies and the Future of Science*, University College Cardiff Press (1984); Stochastic Diffusion of Interplanetary Dust Grains Orbiting Under Poynting-Robertson Forces, *Astron. Astrophys.* 151, 435 (1985) (with M.K. Wallis); Magnetized Fokker-Planck Equation with Quasilinear Diffusion, *Phys. Fluids* 29, 3027 (1986); On Hydromagnetic Critical Layers, *J. Fluid Mechanics* 167, 117 (1986) (with I.A. Eltayeb). Heating and frictional drag on the heliospheric gas by the solar wind, *Astron. Astrophys.* 166, 395 (1986) (with M.K. Wallis); A Statistical Model for Horizontal Mass Flux of Erodible Soil, *Journal of Geophysical Research* D92, 14845 (1987) (with A.G.A.G. Babiker and I.A. Eltayeb); Dynamics of Charged Submicron Grains in Halley's Comet, *European Space Agency Special Publication SP-287*, 351 (1987) (with M.K. Wallis); Ion Distribution Function During ICRH at the Fundamental Frequency, *Physics of Fluids* 31, 596 (1988); Formation and propagation of sand dunes: a nonlinear treatment, *Proceedings of the International Workshop on Sand Transport and Desertification in Arid Lands* (1989) (with I.A. Eltayeb and E.A. Hamza); Relativistic stimulated Brillouin and Raman scattering in a laser-produced plasma, *Physical Review A* 41, 6963 (1990) (with M. Salimullah); Suspension Transport of Wind-Eroded Sand Particles, *Geophys. J. Int.* 104, 147 (1991) (with I.A. Eltayeb); Time-Dependent Transport of Dust, *Journal of Geophysical Research* 96D5, 9337 (1991) (with I.A. Eltayeb); Ultrarelativistic Excitation of Beat Waves in a Hot Magnetized Plasma, *Il Nuovo Cimento* 13D No. 6, 779 (1991) (with M. Salimullah, M.B. Chaudhry and S.M. Khursheed Alam); Low-frequency electrostatic modes in a magnetized dusty plasma, *Phys. Rev. A, Stat. Phys. Plasmas Fluids Relat. Interdiscip. Top. (USA)*, vol. 45, no. 8, 5897-900 (1992) (with M. Salimullah); Two-dimensional transport of dust from an infinite line source at ground-level, *Geophys. J. Int.*, vol. 110, no. 3, 571-6 (1992) (with I.A. Eltayeb); Analytical solutions of the time-dependent quasilinear equation with source and loss term, *Physical Review E*, 48, 1359 (1993) (with E.A. Hamza); Two-dimensional transport of dust from an infinite line source at ground-level: non-zero roughness height, *Geophys. J. Int.*, 115 (1993) (with I.A. Eltayeb); Modeling Soil Transport by Wind in Drylands, *ICTP Report IC/94/26* (1994); Diffusion of dust particles from a point source above ground-level and a line source at ground-level, *Geophys. J. Int.*, 142 (2000) (with I.A. Eltayeb); The evolution of dust emitted by a uniform source above ground-level, *IJMMs*. 1 (2003) (with I.A. Eltayeb). Other Selected Publications: *Proceedings of the Conference on Physics of Desertification*: published by Martinus Nijhoff Publishers (1886). (with F. El-Baz); *Proceedings of the Conference on Role of Women in the Development of S&T in the Third World*: published by World Scientific (1988); Seconding Solutions for Third World Science, *Physics Today*, volume 43 (1990). *Proceedings of the International Conference on Sand Transport and Desertification in Arid Lands*: published by World Scientific Publishing Company (1990) (with El-Baz & Eltayeb). *Magnetic Fusion in Developing Countries*, International Atomic Energy Agency (IAEA) Year Book (1990); S&T for the Socio-Economic Development of Africa; Invited paper prepared for a Presidential Forum Meeting of African Heads of State, Nairobi, Kenya (1992); Scientific Brainpower Development in Africa; Invited paper presented at the Second Presidential Forum Meeting of African Heads of States, Maputo, Mozambique (1994); *Science and Development: Prospects for the 21st Century*, Royal Academy of Overseas Science, Brussels, Belgium (1999); *Science and Technology in Africa*, UNESCO Science Report (2002). (with J. Gaillard and R. Waash); The Cultural Values of Science in the South, Pontifical Academy of Sciences Plenary Session, *Scripta Varia* 105, Vatican City, Italy (2002); Towards a Culture of Scientific Excellence in the South in a Changing World, 75th Anniversary of the Royal Academy of Overseas Sciences, Brussels, Belgium (2003); Innovative Technologies for basic Human Needs and Sustainable Development, International Conference on Frontiers of Science and Technology for Innovation, Rome, Italy (2003); Nanotechnology:

Small things and Big Changes in the Developing World, *Science*, volume 309 (2005); Promoting South-South and North-South Cooperation in Education and Research: a Question of Responsibility, Pontifical Academy of Sciences, *Extra Series* 28, Vatican City (2006); Building Capacities in Life Sciences in the Developing World, *Cell*, volume 2 (2007); Promoting a Culture of Excellence in Scientific Research and Education in DC's, Tenth Annual Jus Lecture, University of Toronto, Canada (2006); The Role of University in Harnessing ICT for Economic Development; PHEA and University of Cape Town Workshop, Cape Town (2006); International Cooperation in Science and Technology for Sustainable Well-Being: Plenary Lecture, AAAS Annual Meeting, San Francisco (2007); STI in and with Africa: invited keynote paper; Conference on Science with Africa organized by ECA, Addis Ababa (2008); China's Coming-Out Party, *Nature* 455 (2008); Promoting Excellence in Research and Education in the Arab and Islamic World: invited lecture, Ministry of Higher Education, Oman (2009); Promoting Excellence in Science and Technology for Sustainable Well-Being in Africa: Keynote, UNESCO Chair Conference on Technologies for Development, Lausanne, Switzerland (2010); Promoting STI for Sustainability in Africa: chapter 28 in *Global Sustainability – a Nobel Cause* (2010); Academies of Science as Key Instruments of Science Diplomacy, *Science and Diplomacy* (2015) (with ter Meulen, Mcgrath and Fears); Migration: the choices we face; *Science* (2017).