



# INSTITUTE FOR COMPLEX HOLISM, Kolkata

A world-class non-degree-granting residential research centre mandated to critical inquiry in the foundations of Chaos-Nonlinearity-complexity and holism in Nature

## What ICH? -- Why?

- *I think the next century will be the century of complexity. We have already discovered the basic laws that govern matter and understand all the normal situations. We don't know how the laws fit together, and what happens under extreme conditions. But I expect we will find a complete unified theory sometime this century. There is no limit to the complexity that we can build using those basic laws.* Stephen Hawking, January 2000.
- *We don't know what we are talking about. Many of us believed that string theory was a very dramatic break with our previous notions of quantum theory. But now we learn that string theory, well, is not that much of a break. The state of physics today is like it was when we were mystified by radioactivity. They were missing something absolutely fundamental. We are missing perhaps something as profound as they were back then.* Nobel Laureate David Gross, December 2005.
- *If string theory turns out to be right, string theorists will turn out to be the greatest heroes of science. ... If string theorists are wrong, they can't just be a little wrong; then we will count string theorists among science's greatest failures. Theirs will be a cautionary tale of how not to do science, how not to let theoretical conjecture get so far beyond the limits of what can rationally be argued that one starts engaging in fantasy.* Lee Smolin, "The Trouble with Physics: The Rise of String Theory, the Fall of a Science, and What Comes Next" (2006).

Science of the last 400 years has essentially evolved by the reductionist tools of linear mathematics in which a composite whole is regarded as the sum of its component parts. Increasingly, however, a realization has grown that most of the important manifestations of nature in such diverse fields as ecology, biology, social, economic and the management sciences, beside physics and cosmology, display holistic behaviour which simply put, is the philosophy that parts of any whole cannot exist and be understood except in their relation to the whole. These complex self-organizing systems evolve on emergent feedback mechanisms and processes that "interact with themselves and produce themselves from themselves": they are "more than the sum of their parts". Thus society is more than a collection of individuals, life is more than a mere conglomeration of organs as much as human interactions are rarely dispassionate.

The Institute for Complex Holism (ICH) has been conceived as an autonomous centre for basic and supporting applied research in the dynamics of open systems that interact with their environment in attaining a state of homeostatic equilibrium. ICH is conceptually distinct, being conceived after the Perimeter Institute for Theoretical Physics at Waterloo (<http://www.perimeterinstitute.ca/en/>) established by the founder of *Research In Motion* with a grant of 100 million dollars, and the Institute of Advanced Studies, Princeton (<http://www.ias.edu/about/>). It is important for such an institution to be academically and financially independent, with full operational autonomy.

The linear reductionist framework of present mainstream science raises many deep-rooted and fundamental questions that defy logical interpretation within its own framework; as do questions involving socio-economic, collective (as opposed to individualistic), and biological relations. The issues raised by this dichotomy have been well known and appreciated for long leading often to bitter and acrimonious debate between protagonists of the reductionist and holistic camps; linear systems cannot be chaotic however, thus complex, and hence holistic. The guiding motto of ICH is a complete and full understanding of the "why-what-how" of the interactive and interdependent nonlinear dialectics of holism and collectiveness. This is expected to lead to a more complete conceptualization and appreciation of the physical, social,

and moral issues in which we are necessarily embedded.

The fundamental mandate of ICH is the furtherance of the scientific unraveling of this tension between individualism and collectivism --- between dispersion and concentration --- in the spirit of open foundational inquiry. This the Institute proposes to achieve by encouraging a synergistic atmosphere of interactive collaboration where resident and visiting academics from across the world can focus on multi- and intra-disciplinary fundamental research in all aspects of chaos-nonlinearity-complexity. Developing a tradition of cross-fertilization that encourages and motivates both orthodox and speculative approaches, ICH will aim to constructively interact with surrounding academia through seminars, workshops, schools and conferences, and appointments in the adjunct and visitor categories. The Institute will encourage and support “fundamental scholarship dedicated to the disinterested pursuit of knowledge” in Physics (focus: quantum and gravity), Mathematics (focus: nonlinear sciences), Biological science, and Social, Economic & Management sciences as an integrated, cross-fertilized, discipline. ICH is more than a centre for complexity research (<http://www.santafe.edu/>): it is designed to be an international hub for the generic patronage and nurture of chaos-nonlinearity-complexity as the new science of collectivism.

ChaNoXity -- the new integrated discipline of Chaos-Nonlinearity-compleXity -- is possibly the first rigorous scientific, self-contained, and unified formulation of complex holism. We are now beginning to understand how these composites work --- why and how “life” sustains itself --- in terms of a new (nonlinear) mathematics with its attendant new physics and new interpretational philosophy and a “metaphor” of reality. ICH aspires to provide a world-class institutional forum for the development and fertilization of this foundation as a hard rigorous science of holism, complementing mainstream reductionism --- linear science has after all stood the test of the last 400 years as quantum mechanics is acknowledgedly one of the most successful yet possibly among the most mysterious of scientific theories. Its success lies in the capacity to classify and predict the physical world --- the mystery in what this physical world must be like to be as it is supposed to --- in order to provide a global dialectic of the dynamics of Nature. The foundations of this new science constitutes the basis of activity at ICH.

We solicit participation and sponsorship from individuals and organizations to transform the ICH dream into reality, adequate to generate the necessary foundation for the Institute to function efficiently and independently. Complex holism --- the self-organizing, emergent manifestation of intense nonlinear interactions of a system with its environment -- cannot arise linearly and be described by traditional reductionist approaches; the distinctive philosophy structured around the distinctive mathematics of ChaNoXity justifies and obligates an institution exclusively dedicated to the cultivation and promotion of this New Science. The large number of teaching and research organizations in and around Kolkata, coupled with its continued interest in the sciences, makes this an ideal location for ICH.