

金融畸形波 (Financial Rogue Waves)

闫振亚

美国 MIT 的学者 Black 和 Scholes 于 1973 年在《Journal of Political Economy》提出著名的 Black-Scholes 期权定价模型[1]

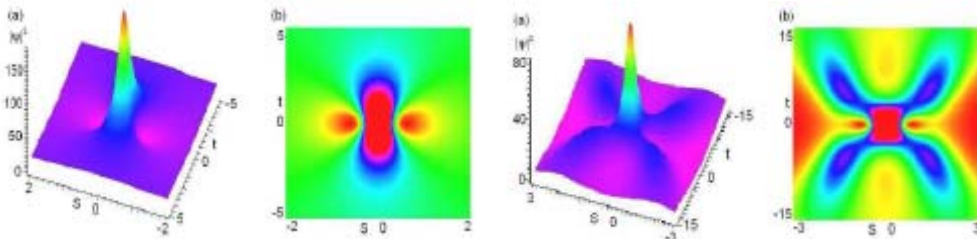
$$\partial_t u = -\frac{1}{2}(\sigma s)^2 \partial_{ss} u - rs \partial_s u + ru,$$

与此同时，MIT 的另一教授 Merton 也独立地提出了相同的模型[2]。之后，该模型受到了人们的普遍的关注与好评，1997 年第 29 届诺贝尔经济学奖授予哈佛商学院的 Merton 教授和斯坦福大学的 Scholes 教授。为了使得该模型更有效地适应于不同的金融市场，人们对它进行了很多方面的发展。基于 Lo 的现代适应性市场假设、Elliott 波市场理论和量子神经计算等理论，2010 年，澳大利亚学者 Ivancevic 提出用非线性的期权价格模型，即非线性 Schrodinger 方程：

$$i\partial_t \psi = -\frac{1}{2}\sigma \partial_{ss} \psi - \beta |\psi|^2 \psi, \quad (i = \sqrt{-1})$$

来描述金融市场波动性的变化规律。

最近，我们通过研究该非线性期权价格模型，在国际上首次显式地提出了它的两种类型的精确解，即金融畸形波解（或金融怪波解）(financial rogue waves) [4].



美国麻省理工学院百年期刊《技术评论》(Technology Review) 以“Econophysicist Predicts Rogue Financial Waves (经济物理学家预言畸形金融波)”为题对我们的工作进行了报道，文中提到：“Today Zhenya Yan at the Institute of Systems Science in Beijing says that rogue waves can also occur in financial systems, and in particular in equity markets.”、“Yan, who points out today that one solution of a nonlinear wave system is a rogue wave, an event of far greater magnitude than would be expected by any standard method of analysis.”、“That's interesting. There's no shortage of anecdotal evidence for the existence of financial rogue waves. Look at the Asian financial crisis of 1997 or the current global financial crisis. But econophysicists will want more than that to confirm that financial rogue waves really exist.”。

另外，美国百年期刊《大众科学》(Popular Sciences) 也对我们的工作以“Econophysicist

Claims Rogue Waves Could Account for Volatility in Financial Markets (经济物理学家认为畸形波可以解释金融市场的波动性)”为题进行了报道， 文中指出“Now, Chinese researchers are positing that rogue waves can occur in financial systems, and could account for events like the 1997 Asia crisis or the current credit crisis sweeping the globe”、“Rogue waves, which we know to be real in other wave-like systems, could solve for the black swan events -- like the subprime mortgage debacle or savings and loan crisis -- that periodically appear as if from nowhere and shake markets to their cores.”。

此外，我国的郭伯灵院士与李邦河院士、英国的 Clarkson 教授、法国 Matveev 教授等在不同的会议上提到这一工作。

参考文献:

- [1] F. Black, M. Scholes, The Pricing of Options and Corporate Liabilities, J. Pol. Econ, 81, 637 (1973) 637.
- [2] R.C. Merton, Theory of Rational Option Pricing, Bell J. Econ. and Management Sci. 4 (1973) 141.
- [3] V. G. Ivancevic, Adaptive-Wave Alternative for the Black-Scholes Option Pricing Model, eprinter, arXiv:0911.1834.
- [4]. Z. Y. Yan, Financial rogue waves, Commun. Theor. Phys., 54 (2010) 947.
[也见 Z. Y. Yan, Financial rogue waves, arXiv:0911.4259.]