



**Franco Prati**

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## Contact data

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## Biography

Franco Prati received his Ph.D. degree in 1993 at the University of Zurich for his studies on spatio-temporal dynamics in lasers. In 1996 he received a permanent position as researcher at the University of Milano and presently he is Associate Professor of Physics of Matter at the University of Insubria.

## Research interests

Franco Prati has been active for almost two decades in the fields of Nonlinear and Quantum Optics. Since 1989 he has participated in several research projects funded by the European Union in the field of Information Technology, as well as two PRINs of the MURST and other INFN and CNR projects. In the last decade his expertise has accumulated in the study of the spatio-temporal dynamics of lasers and related nonlinear optical systems was applied to two particular classes of lasers: the doped fibre lasers and the semiconductor lasers, in particular Vertical Cavity Surface Emitting Lasers (VCSELs).

In this field the most relevant achievements have been published in two pairs of papers which appeared at the end of the 90's (numbered 19,21,22,25 in the list below). They contain more than 300 citations and contain:

- The theoretical prediction, later confirmed by experiments, of the possibility of realizing cavity solitons in semiconductor devices, both passive and active below the threshold of laser emission. This result contributed to the success of the European Project PIANOS
- The detailed study of the properties of the polarization of the light emitted by a VCSELs, in particular of the phenomenon of polarization switching, typical of those lasers, which has been explained on the basis of the so-called spin-flip model, which since then became the reference model for the study of light polarization dynamics in VCSELs.

In the subsequent works the spin-flip model has been extended and applied to the study of the competition between orthogonally polarized transverse modes, of the effects of gain saturation on polarization switching, and of the possibility of generating elliptically polarized states. These researches have been carried out in the years 2000-2004 in the framework of the European Project VISTA in collaboration with

the leader groups in Europe.

Globally, the scientific production of Franco Prati consists of about 50 papers published in international journals.

## Teaching experience and appointments

1999-2001 Quantum Electronics (Degree Course in Physics)  
2001-2003 General Physics (Degree Course in Environmental Sciences)  
2001-2005 Electromagnetism II (Degree Course in Physics)  
2003-2005 Physics B (Degree Course in Engineering for Work and Environment Security)  
2003-2006 Laser Physics (Degree Course in Physics)  
2003-2006 Physics (Degree Course in Computer Science and Technology)

Co-tutor of 24 thesis at the University of Milan and 2 at the University of Insubria

Tutor of 1 thesis at the University of Insubria

## Representative publications

1. L.A. Lugiato, F. Prati, D.K. Bandy, L.M. Narducci, P. Ru, and J.R. Tredicce, Low Threshold Instabilities in Unidirectional Ring Lasers, *Opt. Commun.* 64, 167 (1987)

2. L.A. Lugiato, F. Prati, L.M. Narducci, P. Ru, J.R. Tredicce, and D.K. Bandy, Role of Transverse Effects in Laser Instabilities, *Phys. Rev. A* 37, 3847 (1988)

3. B. Segard, B. Macke, L.A. Lugiato, F. Prati, and M. Brambilla, Multimode Instability in Optical Bistability, *Phys. Rev. A* 39, 706 (1989)

4. L.A. Lugiato, F. Prati, L.M. Narducci, and G.L. Oppo, Spontaneous Breaking of the Cylindrical Symmetry in Lasers, *Opt. Commun.* 69, 387 (1989)

5. M. Brambilla, F. Battipede, L.A. Lugiato, V. Penna, F. Prati, C. Tamm, and C.O. Weiss, Transverse Laser Patterns, I. Phase Singularity Crystals, *Phys. Rev. A* 43, 5090 (1991)

6. M. Brambilla, L.A. Lugiato, V. Penna, F. Prati, C. Tamm, and C.O. Weiss, Transverse Laser Patterns, II. Variational Principle for Pattern Selection, Spatial Multistability, Laser Hydrodynamics, *Phys. Rev. A* 43, 5114 (1991)

7. M. Brambilla, F. Castelli, L.A. Lugiato, F. Prati, and G. Strini, Nondegenerate Four-Wave Mixing in a Cavity: Instabilities and Quantum Noise Reduction, *Opt. Commun.* 83, 367 (1991)

8. M. Brambilla, G. Broggi, and F. Prati, Spatiotemporal Pattern Formation and Chaos in Passive Optical Systems, *Physica D* 58, 339 (1992)

9. M. Brambilla, L.A. Lugiato, M.V. Pinna, F. Prati, P. Pagani, P. Vanotti, M.Y. Li, and C.O. Weiss, The Laser as Nonlinear Element for an Optical Associative Memory, *Opt. Commun.* 92, 145 (1992)

10. C.P.Smith, Y.Dihardja, C.O.Weiss, L.A.Lugiato, F.Prati, and P.Vanotti, Low energy switching of laser doughnut modes and pattern recognition, *Opt. Commun.* 102, 505 (1993)
11. M.Brambilla, M.Cattaneo, L.A.Lugiato, R.Pirovano, F.Prati, A.J.Kent, G.-L.Oppo, A.B.Coates, C.O.Weiss, C.Green, E.J.D'Angelo, and J.R.Tredicce, Dynamical Transverse Laser Patterns, I. Theory, *Phys. Rev. A* 49, 1427 (1994)
12. A.B.Coates, C.O.Weiss, C.Green, E.J.D'Angelo, J.R.Tredicce, M.Brambilla, M.Cattaneo, L.A.Lugiato, R.Pirovano, F.Prati, A.J.Kent, and G.-L.Oppo, Dynamical Transverse Laser Patterns, II. Experiments, *Phys. Rev. A* 49, 1452 (1994)
13. F.Prati, M.Brambilla, and L.A.Lugiato, Pattern Formation in Lasers, *La Rivista del Nuovo Cimento*, Vol. 17, n. 3 (1994)
14. F.Prati, A.Tesei, L.A.Lugiato, and R.J.Horowicz, Stable States in Surface Emitting Semiconductor Lasers, *Chaos, Solitons and Fractals* 4, 1637 (1994)
15. F.Prati, M.Travagnin, and L.A.Lugiato, Optical Switching and Logic Gates with Surface Emitting Semiconductor Lasers, *Opt. Lett.* 19, 1991 (1994)
16. I.Boscolo, L.A.Lugiato, F.Prati, T.Benzoni, and A.Bramati, Low order mode interaction in Lasers with different experimental configurations, *Opt. Commun.* 115, 379 (1995)
17. F.Prati, L.Zucchetti, and G.Molteni, Rotating Patterns in Class-B Lasers with Cylindrical Symmetry, *Phys. Rev. A* 51, 4093 (1995)
18. B.Rohricht, A.W.McCord, M.Brambilla, F.Prati, S.Dangel, P.Eschle, and R.Holzner, Spatial separation of circularly polarized laser beam in sodium vapors, *Opt. Commun.* 118, 601-606 (1995)
19. J.Martín-Regalado, M.San Miguel, N.B.Abraham, and F.Prati, Polarization Switching in Quantum Well Vertical-Cavity Surface Emitting Lasers, *Opt. Lett.* 21, 351-353 (1996)
20. F.Prati, M.Travagnin, and L.A.Lugiato, Logic Gates and Optical Switching with Vertical Cavity Surface Emitting Lasers, *Phys. Rev. A* 55, 690-700 (1997)
21. J.Martín-Regalado, F. Prati, M.San Miguel, and N.B.Abraham, Polarization Properties of Vertical Cavity Surface Emitting Lasers, *IEEE Journal of Quantum Electronics* 33, 765-783 (1997)
22. M.Brambilla, L.A.Lugiato, F.Prati, L.Spinelli, and W.J.Firth, Spatial Soliton Pixels in Semiconductor Devices, *Phys. Rev. Lett.* 79, 2042-2045 (1997)
23. F.Prati, G.Tissoni, M.San Miguel, and N.B.Abraham, Vector vortices and polarization state of low-order transverse modes in a VCSEL, *Opt. Commun.* 143, 133-146 (1997)

24. F.Prati, D.Vecchione, and G.Vendramin, Frequency locking of supermodes and stability of the out-of-phase locked state in 1-D and 2-D arrays of VCSELs, *Opt. Lett.* 22, 1633-1635 (1997)
25. L.Spinelli, G.Tissoni, M.Brambilla, F.Prati, and L.A.Lugiato, Spatial Solitons in Semiconductor Microcavities, *Phys. Rev. A* 58, 2542-2559 (1998)
26. G.de Valcárcel, E. Roldán, and F. Prati, Risken-Nummedal-Graham-Haken instability in class-B lasers, *Opt. Commun.* 163, 5-8 (1999)
27. E.M.Pessina, F.Prati, J.Redondo, E. Roldán, and G.de Valcárcel, Multimode Instability in Ring Fibre Lasers, *Phys. Rev. A* 60, 2517-2528 (1999)
28. F. Prati, P. Caccia, and F. Castelli, Effects of gain saturation on polarization switching in vertical-cavity surface-emitting lasers, *Phys. Rev. A* 66, 063811 (2002)
29. F. Prati, P. Caccia, M. Bache, and F. Castelli, Analysis of elliptically polarized states in vertical-cavity-surface-emitting laser, *Phys. Rev. A* 69, 033810 (2004)
30. E. Roldán, G.J. de Valcárcel, F. Prati, F. Mitschke, and T. Voigts, Multilongitudinal mode emission in ring cavity class B lasers, in *Trends in Spatiotemporal Dynamics in Lasers, Instabilities, Polarization Dynamics, and Spatial Structures*, Eds. O.G. Calderon and J.M. Guerra, (Research Signpost, Kerala, India) (2005).