

Nota curriculare di Francesco Mallamace

Francesco Mallamace si laurea in Fisica nel 1973. Nel 1974 viene chiamato come “research and teaching assistant” alla Purdue University (USA). Nel 1976 è nominato professore incaricato di Ottica presso l’Università di Messina; nel 1981 diviene professore associato di Struttura della Materia e nel 1986 di Fisica Generale. Dal 2000 è professore ordinario di Fisica Generale.

L’attività scientifica di Francesco Mallamace, come testimoniano oltre 200 pubblicazioni su giornali internazionali (molti su riviste di assoluta eccellenza e.g. *Science*, *Nature*, *PNAS*), è stata principalmente indirizzata allo studio sperimentale della Fisica e Chimica dei Sistemi Complessi ed alla interazione radiazione-materia. Ha dato contributi fondamentali allo studio di questi sistemi nelle fasi di non-equilibrio e nelle transizioni di non-ergodicità (gels, colloids, microemulsions, glass materials, polymers, supercooled water, etc.). Inoltre ha sviluppato nuove tecnologie sperimentali nello studio delle interazioni radiazioni-materia tramite spettroscopia di Risonanza Magnetica Nucleare (NMR) a Scattering di luce e neutroni; in questo ultimo caso tramite flussi di neutroni di alta intensità sia provenienti da reattori nucleari quanto da sorgenti a spallation localizzate nei National Laboratory – USA (Oak Ridge, Argonne, NIST, Brookhaven). Allo stesso tempo ha sviluppato specifici modelli di analisi quantitativa di dati sperimentali proprio per questi materiali, e.g. uno dei modelli più utilizzati per sistemi colloidali è il “*cap-and-gown*” model (1995). Con queste tecniche ha studiato sperimentalmente, ottenendo risultati rimarchevoli, i sistemi fisici in condizioni termiche di non-linearità.

Un risultato recentissimo di FM considerato di grande impatto scientifico e pubblicato sui Proceedings della National Academy of Science USA (Dicembre 2010), sta nella dimostrazione che esiste un comportamento universale nei processi di trasporto dei liquidi sottoraffreddati e glass-forming, caratterizzato dalla esistenza di una specifica temperatura di crossover dinamico.

Nel recente (anni 2005-2011) FM ha contribuito a risolvere uno dei problemi fondamentali della Fisica e della Biologia, ossia: chiarire in maniera definitiva l’origine delle anomalie dell’acqua liquida. Per una di queste ricerche che dimostra, per l’ acqua confinata la violazione della legge di Stokes-Einstein è stato premiato nel 2007 dalla National Academy of Science USA con la motivazione: *‘la più eccellente ed originale scoperta scientifica nel settore delle scienze fisiche applicate pubblicata nel 2006’*. Altro risultato di largo interesse è la scoperta di una temperatura singolare dell’ acqua nel diagramma pressione-temperatura che caratterizza in maniera univoca i comportamenti delle funzioni termodinamiche densità, compressibilità ed espansività

Altro recente risultato conseguito, di largo impatto scientifico, è la dimostrazione che la tecnica di Risonanza Magnetica Nucleare può essere utilizzata con successo nella caratterizzazione e nello studio delle proprietà conformazionali ed energetiche di macromolecole di interesse biologico quali proteine, enzimi, RNA e DNA. L’applicazione tecnologica di questi studi apre concrete prospettive nelle diagnosi precoci di alcune forme tumorali (soprattutto i melanomi) e delle malattie neurodegenerative dipendenti dal misfolding proteico e amiloidosi.

Gli interessi e le competenze scientifiche di Francesco Mallamace si sono estese anche a settori di generale interesse per il nostro Paese, quale quello delle indagini diagnostiche non distruttive sul patrimonio artistico. Nel particolare FM è stato punto di riferimento, su queste tematiche, di alcuni progetti dell’Unione Europea.

Dal 1999 FM è visiting professor al Physics Department della Boston University (BU) “*Center of Polymer Science*”, dove collabora nello studio delle proprietà dell’acqua e dei sistemi biologici.

Dal 1997 è Professor research affiliate e Visiting Professor al Massachusetts Institute of Technology (MIT, Cambridge-USA) presso il “Department of Nuclear Science and Engineering” e svolge attività didattica e di ricerca nel settore delle interazioni radiazione-materia e nell’uso dei Liquidi Complessi sia come “*fuel-moderator nanocontainers*” e “*cooling liquids*” sia come “*high-efficient heat-drivers*” per i reattori nucleari della prossima (nuova) generazione.

Dal 2001 FM è responsabile scientifico del Centro di Risonanza Magnetica Nucleare (NMR) del Consiglio Nazionale delle Ricerche e dell’Istituto Nazionale per la Fisica della Materia: Facility Nazionale, presso l’Università di Messina, per lo studio della materia soffice condensata e nano-materiali di interesse biologico (laboratorio di interesse nazionale finanziato con fondi Europei).

Il gruppo di ricerca, presso l’Università di Messina, di cui FM ha la responsabilità scientifica è nodo di uno dei più prestigiosi network di eccellenza di ricerca e formazione dell’Unione Europea; tale network denominato “Arrested Matter in colloidal science” coinvolge 14 Atenei Europei e due USA.

Per i contributi dati nelle citate aree di ricerca FM ha svolto numerose relazioni su invito nei principali congressi, conferenze e workshops internazionali; ha scritto molti “review papers” e capitoli di libri scientifici ed è stato invitato a collaborare all’attività editoriale di alcune prestigiose riviste internazionali (*Physical Review E&B, Physical Review Letter, Physica A, J. of Chemical Physics, and J. of Physical Chemistry, Langmuire, The Royal Phylosophycal Magazine, Farady trans. & Farady disc., Il Nuovo Cimento, La Rivista del Nuovo Cimento, J. of Physical Chemistry (A and B), J. de Physique, European Physical. J. E, J. of Physics - Condensed Matter, Proceedings of the National Academy of Sciences, PNAS, Nature e Science*). FM è socio di: La Società Italiana di Fisica, The American Physical Society (di cui è anche fellow), American Chemical Society e Royal Society of Chemistry. Dal 2009 è membro del Consiglio Scientifico (Sub. Comm. 8 Bio) del Laboratorio Europeo ILL di Grenoble (Francia)..

FM si è impegnato in particolar modo nell’attività di sviluppo, di promozione e di diffusione su scala globale delle tematiche di ricerca sopra menzionate, promuovendo, organizzando e dirigendo, sia in Italia sia all’estero, molti congressi. Sempre per queste tematiche è stato negli anni 2005-2007 consulente del Parlamento Europeo per la ricerca e lo sviluppo tecnologico nell’ambito del VII° Programma Quadro della EU (2007-2013). In questo contesto l’11-01-2006 ha partecipato presso il Parlamento Europeo ad una Public Hearing sul programma “*People*”, programma indirizzato ai progetti comunitari per la formazione del ‘ricercatore europeo’.

FM si è inoltre distinto nell’attività di formazione di eccellenza. Ha infatti organizzato e diretto alcune scuole internazionali per giovani ricercatori. Tra cui, per conto della Società Italiana di Fisica, la prestigiosissima *International School of Physics “Enrico Fermi”* di Varenna, che ha organizzato e presieduto tre volte. Le scuole, tenutesi nel 1996, nel 2003 e nel 2010, hanno avuto come tematica principale “*The Physics of complex systems*”, un settore di ricerca che copre tutte le aree della Fisica, dal Nucleare alla Biofisica. Entrambe le scuole si sono distinte per il numero e la qualità dei partecipanti ed il prestigio delle docenze affidate ai massimi studiosi mondiali del settore.

FM fra Messina, BU ed MIT ha curato, come responsabile, i processi di formazione (dottorati, PhD ed attività post-Doc), di alcune decine di giovani ricercatori di differente nazionalità (USA, Francia, Germania, Irlanda, Giappone, Olanda, Cina, Taiwan, Australia, Nuova Zelanda, India, Israele, Grecia,

Spagna, Brasile, Argentina, Messico, Canada, Iran e naturalmente Italia), che sono oggi quasi tutti occupati come professori universitari o come ricercatori.

L'attività di ricerca di FM, prevalentemente inquadrata in progetti strategici internazionali o di interesse nazionale (PRIN), è stata supportata con continuità sia da Enti di ricerca Nazionali (Ministero Ricerca e Industria, CNR, ENEA, etc.) sia internazionali (Fondi Europei, Fondi PON, National Science Foundation e NASA (USA)). Alcune delle sue ricerche sono state svolte in collaborazione con strutture nazionali (*CNR, ENEA, Università di Pavia, Roma, Milano, Perugia, Napoli, Firenze, Pisa*) ed internazionali (*MIT, Boston Univ., Parigi, LURE-Orsay, LLB-Saclay, Belfast, Dublino, Edimburgo, Bayreuth, Costanza, Colonia, Los Angeles, New York, Tel Aviv, Tokio, etc.*). Per quanto riguarda i progetti di ricerca sulla interazione "radiazione-materia" e sul nucleare, FM ha beneficiato e continua a beneficiare della aperta disponibilità delle strutture (e della collaborazione dei ricercatori) di alcuni "National Laboratories USA", quali: Los Alamos, Oak Ridge, Argonne (Chicago), National Institute of Standard and Technology (Gaithersburg), Brookhaven (New York).

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