98e rencontre entre mathématiciens et physiciens théoriciens : Hommage à René Thom IRMA, 1-3 septembre 2016

ABSTRACTS

Norbert A'campo – Bâle

Singularities by René Thom

André Haefliger - Genève

Un survol de la correspondance de René Thom et quelques souvenirs personnels

Note.-- This talk will be in French, because Thom's correspondence is in French

Françoise Thom - Paris

Evocation de René Thom

François Laudenbach - Nantes

René Thom and an anticipated h-principle

S. Smale's 1957 announcement, ``A classification of immersions of the 2-sphere,'' was a breakthrough in immersion theory, leaving R. Bott doubtful for a while. Shortly after, R. Thom lectured on this topic in Bourbaki Seminar (Dec. 1957) and offered the first picture, just a bump, which is really the key for flexibility of immersions (in a sense specified later on by M. Gromov). Thom's picture is also the germ of the beautiful ``Theory of corrugations'' sketched by W. Thurston in the booklet joined to the famous video ``Outside In'' by S. Levy. By using corrugations V. Borrelli (2013) gave an almost concrete isometric embedding of the flat 2-torus into 3-space. In 1959, on the occasion of a CNRS conference in Lille, Thom, likely inspired by his thought on immersions, announced what I call today a homological h-principle; we are ten years before Gromov's thesis where the homotopical h-principle have been launched (without its name). A precise statements of both will be given in my talk. Strangely enough, Thom was not confident in his theorem which is nowadays known to be true.
The article in question contains very few details but it claims the existence of a very surprising subdivision of the n-simplex said by Thom to be ``with strong gradient''. Actually, thanks to it, Thom makes a jiggling construction, similar (in advance) to the one by Thurston in his first important piece on foliations (1974).
I will make this subdivision of the n-simplex explicite and give an application to geometric structures on open manifolds (joint work with Gael Meigniez, J. Ecole polytechnique, 2016).

Massimo Ferri - Bologna

Catastrophe theory in robotics

Marc Chaperon - Paris

Catastrophes : memories and perspectives

The release of René Thom's book Stabilité structurelle et morphogénèse in 1972 marked the beginning of an extraordinary enthusiasm for catastrophe theory. In 1978, a rather negative article by Stephen Smale in the Bulletin of the American Mathematical Society put a brutal end to this craze. Almost forty years later, having forgotten all that madness, one can come back to Thom's ideas and their more or less explicit influence on present-day science.

Pierre Cartier - IHES

René Thom and real algebraic geometry

Je commencerai par rappeler les souvenirs de ma cohabitation avec René Thom, et le Séminaire commun que nous organisames en 1962/63 . Thom était un géomètre , avec un intérêt permanent pour les singularités (d'applications , par exemple) . Malgré les spectaculaires résultats de la géométrie projective complexe , au 19ème siècle , il trouvait plus pertinent la géométrie algébrique réelle , pour ses liens avec la topologie par exemple . La géométrie algébrique réelle était encore vers 1960 dans l'enfance . Je rappellerai ce qui nous était connu à l'époque , puis je tracerai à grand trait les progrès des cinquante dernières années , fortement influencés par la théorie des modèles en logique mathématique (une théorie de la constructivité , et de sa complexité) . Je terminerai par l'allusion à une passerelle possible vers une autre obsession strasbourgeoise , vers une autre obsession strasbourgeoise, l'analyse non standard, chère à Georges Reeb.

Marc Levine - Duisburg-Essen

Thom spaces and cobordism in algebraic geometry

We give a review of Voevodsky's construction of the algebraic cobordism spectrum in the motivic stable homotopy category, the geometric construction of algebraic cobordism (Levine-Morel-Pandharipande) and the comparison isomorphism, relying on the theorem of Hopkins-Morel, recently proved and extended by Hoyois. We will also discuss other oriented theories, such as BP theory and Morava K-theories, and their geometric counterparts.

Alain Chenciner - Observatoire de Paris

The two ways of stability in dimension 2 : normal hyperbolicity and tangential twist

Perturbing the germ at the origin of a rotation of the plane leads to two celebrated results : the Andronov-Hopf bifurcation of invariant curves under a generic radial hypothesis of weak attraction (or repulsion) and the Moser invariant curve theorem under a tangential twist hypothesis in the area preserving case, the last one exposed by Thom in the Bourbaki seminar in December 1963. The invariant curves whose existence is proved are normally hyperbolic with generic induced dynamics in the first case, with a dynamics smoothly conjugated to a diophantine rotation in the second one. In generic 2-parameter families of germs of diffeomorphisms of the plane near a fixed point, the tension between radial and tangential (or hyperbolic and elliptic) behaviour leads to phenomena where the whole richness of the area preserving situation is unfolded along some direction of the parameter space.

Toru Ohmoto - Hokkaido

Thom polynomials since 1957

I will review the current state of the Thom polynomial theory.
Thom polynomials are universal characteristic classes associated to singularity types of differentiable or holographic maps -- he theory involves classifications of map-germs, classifying spaces of Lie groups and cobordism theory. It provides a systematic approach to enumerative geometry from classics to moderns, Schubert calculus, counting curves (Gromov-Witten invariants etc), Vassiliev-type invariants and so on.

Franck Jedrzejewski - CEA, Saclay

Diagrammes et singularités René Thom

Je voudrais montrer dans cet exposé comment la notion de singularité est entrelacée à celle de diagrammes et à leurs interprétations. Il s'agit dans un premier temps de revenir sur quelques idées importantes développées par René Thom, d'affirmer leur pertinence et de les restituer dans l'histoire récente. Dans un deuxième temps, il s'agit de montrer que, à partir des écrits de Thom, la théorie des catastrophes a une interprétation ontologique diagrammatique. Enfin dans un dernier moment conclusif, nous envisageons la réception de la théorie des singularités et ses liens avec les diagrammes de Dynkin et commentons l'idée d'une sémiophysique comme dynamique aristotélicienne.

Gwénaël Massuyeau - Strasbourg

Cobordism theory and homology cylinders in dimension three

In the early 50's, V. Rokhlin and R. Thom proved that any closed oriented 3-manifold is the boundary of a compact oriented 4-manifold. Thom obtained this result in the general framework of his cobordism theory (Comm. Math. Helv. 1954) but, before that, he also proposed two direct proofs which seem to be rather unknown (Colloque de Topologie de Strasbourg, 1951 & 1952).
In this talk, we will survey the three proofs by Thom of that low-dimensional fact which, in his terminology, states that the third oriented cobordism group "Omega_3" is trivial. Next, and despite the triviality of this group, we will explain how the cobordism theory can be used to produce some interesting representations of the *homology* cobordism group H(S) of 3-dimensional homology cylinders over a surface S. All together, these representations produce a one-cocycle on H(S), from which we can show that the rational abelianization of H(S) is non-trivial. (This last part is joint work with T. Sakasai.)

Bernard Teissier - Paris

Thom and analytic singularities

I will present some ideas of Thom on discriminants, polar curves and monodromy.