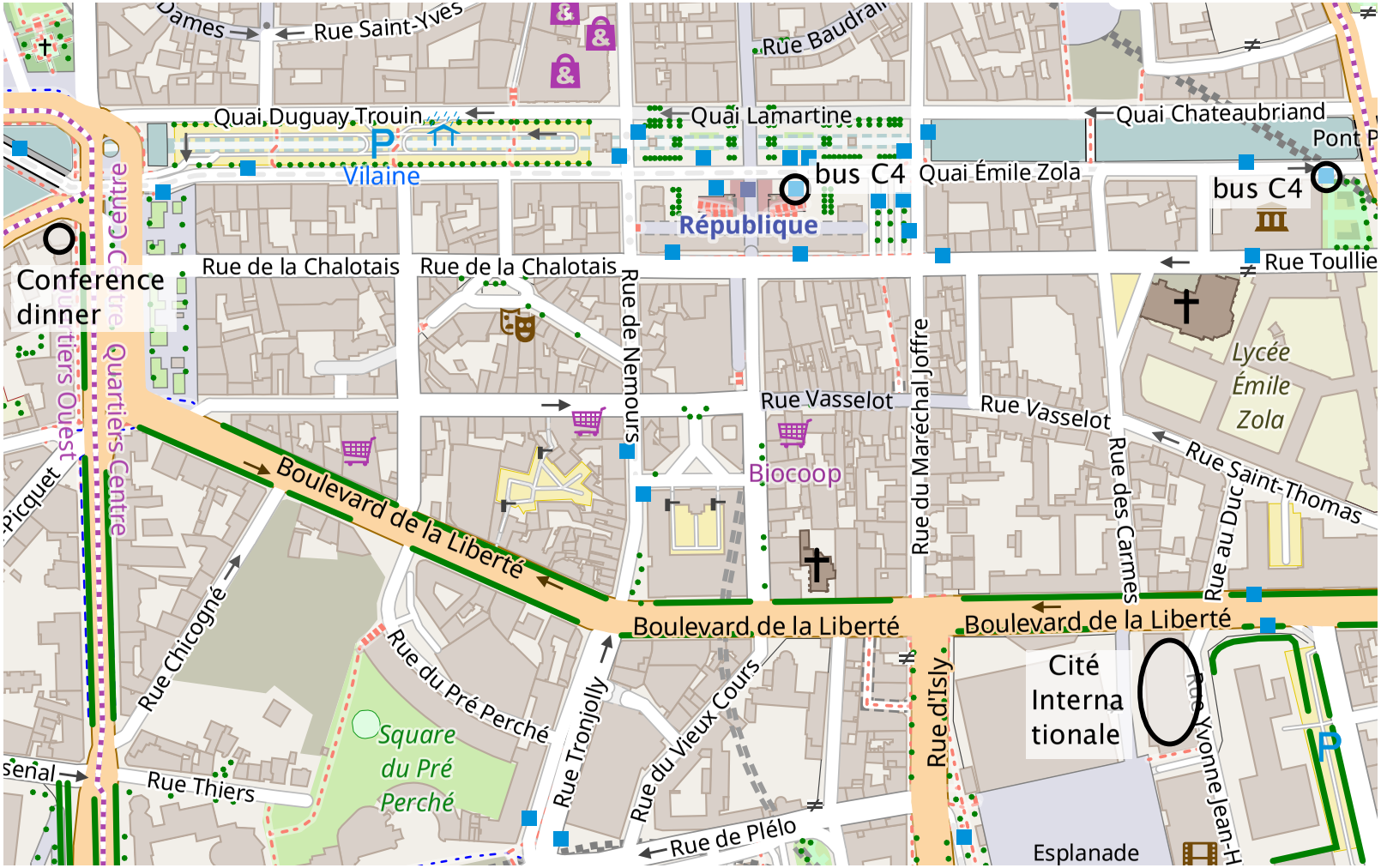
Local and global dynamics of concentrated vortices

May 22–24, 2017, Rennes

	Monday	Tuesday	Wednesday
9:00 am		Diego Córdoba	James Kelliher
9:30 am			
10:00 am		Juan Soler	Sergey Denissov
10:30 am			
11:00 am	Welcome	Coffee	Coffee
11:30 am	Joan Mateu	Alberto Enciso	Thomas Bartsch
12:00 am			
12:30 am	Lunch	Lunch	Lunch
1:00 pm			
1:30 pm			
2:00 pm			
2:30 pm	Thierry Gallay	Darren Crowdy	
3:00 pm			
3:30 pm	David Dritschel	Franck Sueur	
4:00 pm			
4:30 pm	Coffee	Coffee	
5:00 pm	Eduard Feireisl	Tarek Elgindi	
5:30 pm			
6:00 pm			

The conference dinner will take place Tuesday evening, at 8pm. The restaurant is “Taverne de la Marine”, located 2, Place de Bretagne. It is a 5 minutes walk westward from République square (see the map behind).


Rue Saint-Yves
Quai Duguay-Trouin
Vilaine
Quai Lamartine
Rue Baudrais
Quai Chateaubriand
Pont P
bus C4
Quai Émile Zola
bus C4
République
Rue Toullier
Conference dinner
Rue de la Chalotais
Rue de la Chalotais
Rue de Nemours
Rue Vasselot
Rue Vasselot
Rue du Maréchal Joffre
Rue des Carmes
Rue Saint-Thomas
Lycée Émile Zola
Quartiers Centre
Quartiers Ouest
Biocoop
Boulevard de la Liberté
Boulevard de la Liberté
Boulevard de la Liberté
Rue Chicogné
Rue du Pré Perché
Square du Pré Perché
Rue Tronjolly
Rue du Vieux Cours
Rue d'Isly
Cité Internationale
Rue Thiers
Rue de Plélo
Esplanade

Book of abstracts

Speaker: **Thomas Bartsch**
Title: *Periodic solutions of the N-vortex problem in domains*
Abstract: We present recent results on the existence of periodic solutions of the Hamiltonian system for N point vortices in bounded domains $\Omega \subset \mathbb{R}^2$.

Speaker: **Diego Córdoba**
Title: *Stability shifting and mixing solutions for the Muskat problem*
Abstract: The Muskat equation governs the motion of an interface separation of two incompressible fluids in a porous media. In this talk I will present the following recent results:

(1) The existence of solutions which shift stability regimes in the following sense: they start stable, then become unstable, and finally return back to the stable regime before it breaks down (joint work with J. Gomez-Serrano and A. Zlatos).

(2) The existence of mixing solutions of the incompressible porous media equation for all Muskat type H^5 initial data in the fully unstable regime (joint work with A. Castro and D. Faraco).

Speaker: **Darren Crowdy**
Title: *Theoretical results on compressible vortex streets*
Abstract: The theory of compressible vortex structures is significantly less well developed than the incompressible case where much more is known. This talk will survey a variety of recent mathematical results involving steady compressible vortex streets which are ubiquitous features in fluid dynamics arising, for example, in bluff-body wakes. It will be demonstrated that by using a hollow vortex model of the vortices significant mathematical progress can be made in the weakly compressible case. Mathematically, a nonlinear free boundary problem must be solved and, in the two-dimensional setting, we show that there is great advantage in combining conformal mapping ideas with the so-called Imai-Lamla method for weakly compressible flows. Joint work with V. Krishnamurthy.

Speaker: **Sergey Denissov**
Title: *Stable and unstable stationary patches for the two-dimensional Euler equation of fluids*
Abstract: We will discuss the stability of the sufficiently long rectangular patch of vorticity for the Euler dynamics on the strip. Then, we will consider the problem of merging for the central pair of patches. The family of stationary states for the related model equation will be shown to exist.

Speaker: **David Dritschel**
Title: *V-states at finite deformation length*

Speaker: **Tarek Elgindi**
Title: *Various applications of a new inequality*
Abstract: We begin by presenting a simple inequality about the regularity of functions with bounded Laplacian satisfying a symmetry assumption. We then discuss three applications of this inequality to the 2D incompressible Euler equation. First, we discuss how the inequality is used to prove global well-posedness of the 2D Euler equation for L^∞ vorticity (without decay assumptions) as well as a new critical class. As a consequence, we define and discuss the time-evolution of 0-homogeneous vorticity profiles which satisfy a new 1D PDE. Second, we discuss how the inequality can be used to prove propagation of logarithmic singularities which are well outside of the existing well-posedness classes (Yudovich, Vishik, etc.). If there is time, we will also discuss how to prove propagation of vortex patches with corners.

Speaker: **Alberto Enciso**
Title: *Reconnection of vortex structures in the 3D Navier-Stokes equations*
Abstract: An important property of the 3D Euler equations is that the topology of the vortex structures of the fluid does not change in time as long as the solutions do not develop any singularities. To put it differently, the set of (say) vortex tubes and vortex lines of the fluid at time t is diffeomorphic to that of the initial vorticity, provided that the solution remains smooth up to this time. Of course, numerical simulations and experiments with real fluids have shown that the situation is completely different in the case of viscous fluids. In this talk we will show how vortex tubes and vortex lines, of arbitrarily complex topologies, are created and destroyed in smooth solutions to the 3D Navier-Stokes equations. This is joint work with Renato Luca and Daniel Peralta-Salas.

Speaker: **Eduard Feireisl**
Title: *Weak solution approach to problems in fluid mechanics*
Abstract: We discuss the concept of weak or even measure-valued solution in fluid mechanics. We show that that despite their generality, both solution comply with the so-called weak-strong uniqueness principle. In addition, we discuss some ill-posedness results that can be obtained in the context of inviscid fluids by the method of convex integration.

Speaker: **Thierry Gallay**
Title: *Stabilization of rapidly rotating two-dimensional vortices*
Abstract: It has long been known that radially symmetric viscous vortices in two dimensions are stable for arbitrarily large circulation Reynolds numbers, and that perturbations are damped at a faster polynomial rate when the rotation speed is increased. The aim of this talk is to provide a rigorous justification of these experimental facts in the archetypal case of the self-similar Lamb-Oseen vortices. Our analysis relies on pseudospectral estimates for the linearized operator that have been obtained recently by Te Li, Dongyi Wei, and Zhifei Zhang.

Speaker: **James Kelliher**
Title: *Non-decaying solutions to the 2D Euler equations*
Abstract: I will give an overview of what is known about weak solutions to the 2D Euler equations in the plane for which neither the vorticity nor the velocity decay at infinity. This will include joint work with David Ambrose, Elaine Cozzi, Milton Lopes Filho, and Helena Nussenzveig Lopes.

Speaker: **Joan Mateu**
Title: *Rotating vortex patches and dislocations: the ellipse law*
Abstract: In this talk I will present some result obtained in the last years on the existence and smoothness of rotating vortex patches. I also explain how the techniques developed in fluid mechanics turn out to be useful in a completly different context: to study edge dislocations in metals. We will see the special role that ellipses play in both cases.

Speaker: **Juan Soler**
Title: *Exploring new solutions to the incompressible Euler equations*
Abstract: The idea of this talk is to introduce some special solutions of the incompressible Euler equation in two and three dimensions through the connection with other systems of interest such as the Schrödinger, Helmholtz or Allen-Cahn equations, by means of appropriate changes of coordinates and bifurcation theory.

Speaker: **Franck Sueur**
Title : *Point vortex dynamics as 0-radius limit of the motion of rigid bodies in a perfect incompressible fluid*
Abstract: The vortex point system is usually considered as an idealized model where the vorticity of an ideal incompressible two-dimensional fluid is concentrated in a finite number of moving points. In this talk I will present some results obtained in collaboration with O. Glass, C. Lacave and A. Munnier which establish that point vortex dynamics can also be obtained as zero-radius limit of rigid bodies motions under the influence of the force exerted by the fluid pressure on its boundary.