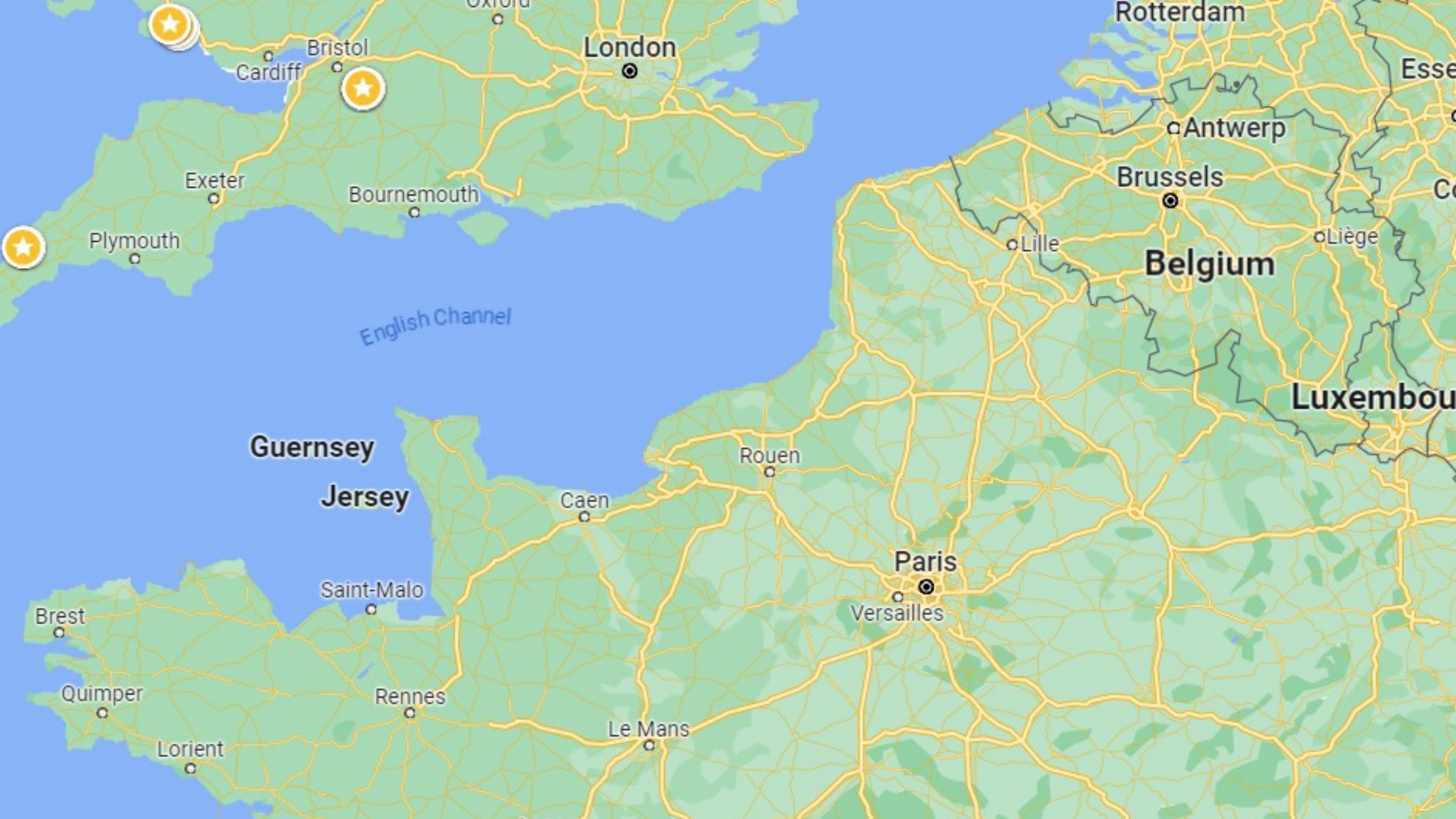
On morning in a sleepy German village…

James Arthur

WARNING: THIS TALK CONTAINS FRENCH

MIA (really really sad)


Bristol
Cardiff
London
Exeter
Bournemouth
Plymouth
English Channel
Guernsey
Jersey
Rouen
Caen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Liège
Belgium
English Channel
Guernsey
Jersey
Rouen
Caen
Paris
Versailles
Saint-Malo
Brest
Quimper
Rennes
Le Mans
Lorient


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Essen
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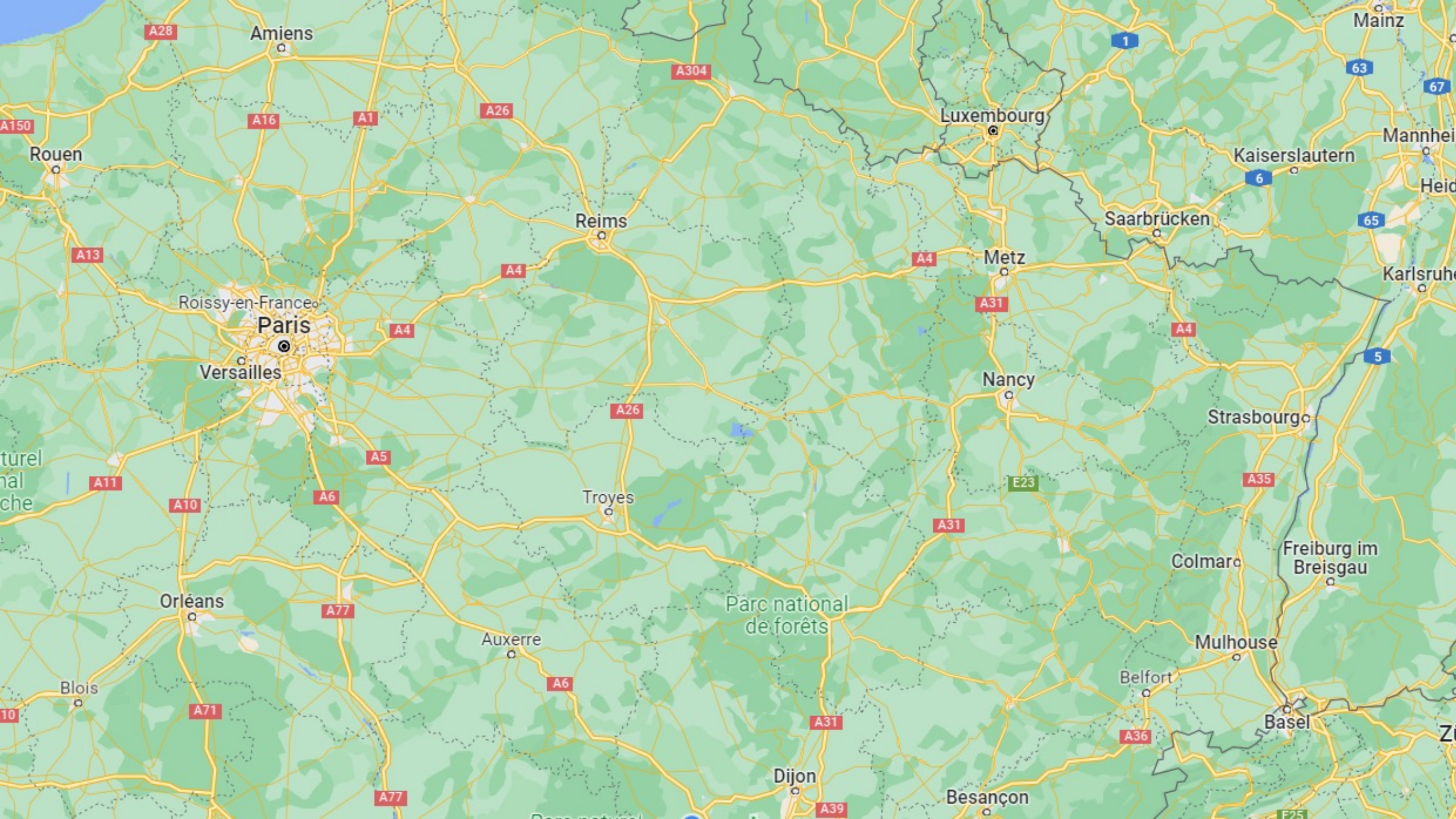
Paris
Saint-Malo
Versailles
Strasbourg
Rennes
Freiburg im Breisgau
Le Mans
Angers
Tours
Basel
Zürich


Luxembourg
Mannheim
Karlsruhe
Paris
Versailles
Strasbourg
Freiburg im
Breisgau
Basel
Zürich
Dijon


Amiens
Rouen
Reims
Luxembourg
Mainz
Kaiserslautern
Saarbrücken
Metz
Karlsruhe
Roissy-en-France
Paris
Versailles
Nancy
Strasbourg
Troyes
Orléans
Auxerre
Parc national de forêts
Colmar
Freiburg im Breisgau
Mulhouse
Belfort
Basel
Blois
Dijon
Besançon
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A150
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A71
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E23
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1
63
67
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A4
Metz
A4
Karlsruhe
A31
A4
5
Nancy
A26
Strasbourg
E23
A35
Troyes
A31
Freiburg im
Breisgau
Colmar
Parc national
de forêts
Auxerre
Mulhouse
A6
Belfort
A31
Basel
A36
Dijon
Besançon
A39


Oberhausbergen
Schiltigheim
AUENHEIM
Zénith de Strasbourg
N4
A4
Av. des Vosges
Parc de
l'Orangerie
Rhine River
Kinzig
Wolfisheim
Cathédrale Notre-Dame
de Strasbourg
KRUTENAU
Eckbolsheim
KOENIGSHOFFEN
A35
Kehl
28
Le Vaisseau
Strasbourg
D445
NEUDORF
NEUMÜH
Weißtannenturm
PLAINE DES
BOUCHERS
Ceci n’est pas un train
Lingolsheim
Ostwald
A35


Hall Central


Oberhausbergen
Schiltigheim
AUENHEIM
Zénith de Strasbourg
N4
A4
Av. des Vosges
Parc de l'Orangerie
Rhine River
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Wolfisheim
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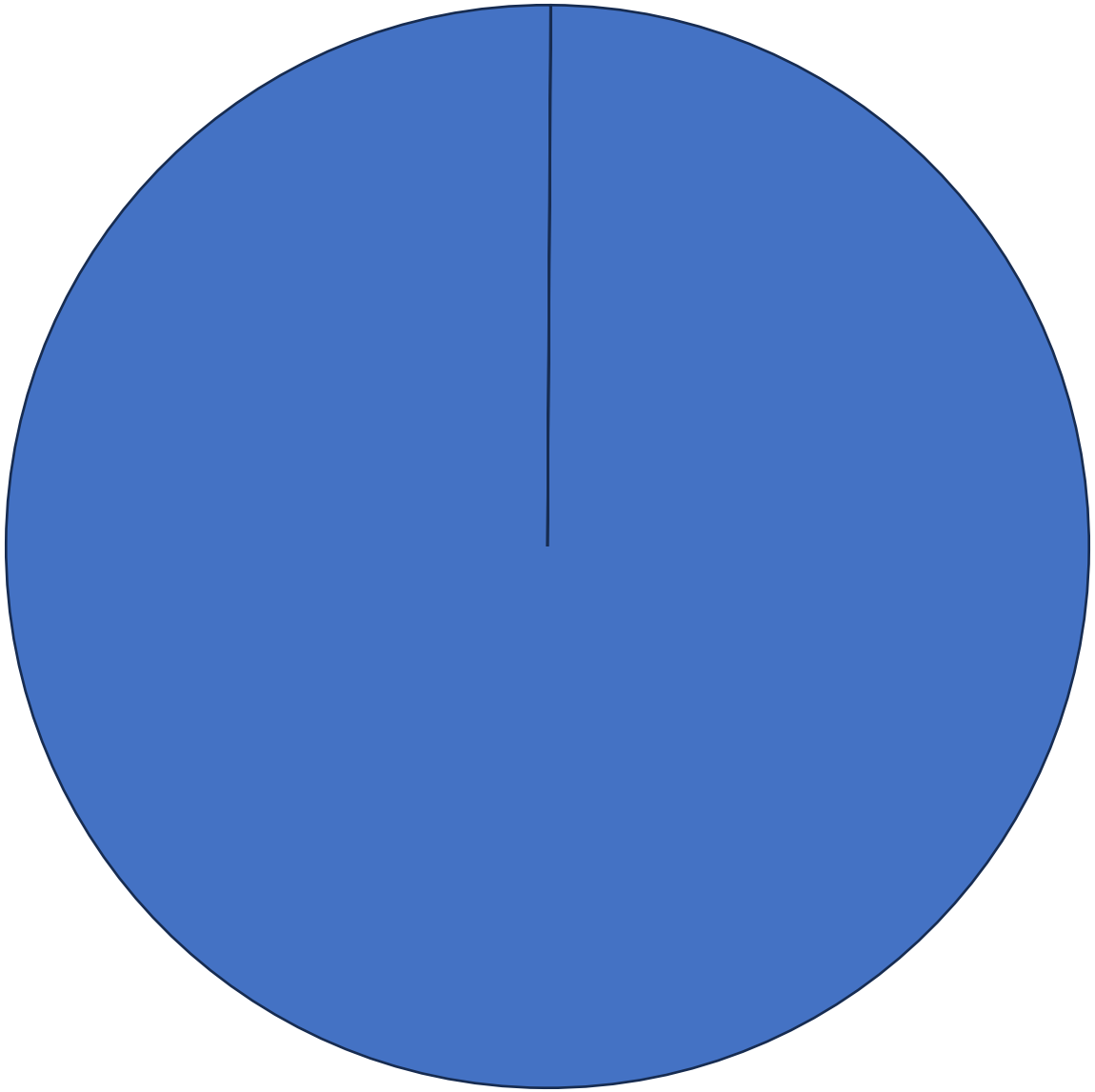
NEUMÜH
Weißtannenturm
PLAINE DES BOUCHERS
Ceci est un tram
SUNDHEIM
Lingolsheim
Ostwald
A35


WC

How do we talk mathematically about this fountain?

S

!




3D System
2D System

PROJECTILE MOTION!

Complicated System

Simple System

Symmetry  Systems

Hotel  Trivago

Other comparison sites are available

Theorem 2.2.1 (Basic Euler-Poincaré). *Let G be a topological group that admits a smooth manifold structure with smooth right translation, and let $L : TG \to \mathbb{R}$ be a right invariant Lagrangian. Let $\mathfrak{g}$ denote the fiber T_eG, and let $\ell : \mathfrak{g} \to \mathbb{R}$, the restriction of L to $\mathfrak{g}$. For a curve $\eta(t) \in G$, let $\mathbf{u}(t) = TR_{\eta(t)^{-1}}\eta(t)$. Then TFAE,*

- *$\eta(t)$ satisfies the Euler-Lagrange Equations,*
- *$\eta(t)$ is an extremum of the action,*

$$S(\eta, \dot{\eta}) = \int L(\eta(t), \dot{\eta}(t))\ \mathrm{d}t,$$

- *$\mathbf{u}(t)$ solves the Basic Euler-Poincaré equations,*

$$\frac{\partial}{\partial t}\frac{\delta \ell}{\delta \mathbf{u}} = -\mathrm{ad}^*_{\mathbf{u}}\frac{\delta \ell}{\delta \mathbf{u}},$$

where the coadjoint action is defined by,

$$\langle \mathrm{ad}^*_{\mathbf{u}} v\,, \mathbf{w}\rangle = \langle v\,, [\mathbf{u}, \mathbf{w}]\rangle\,.$$

- *$\mathbf{u}(t)$ is the extremum of the reduced action,*

$$s(\mathbf{u}) = \int \ell(\mathbf{u}(t))\,\mathrm{d}t,$$

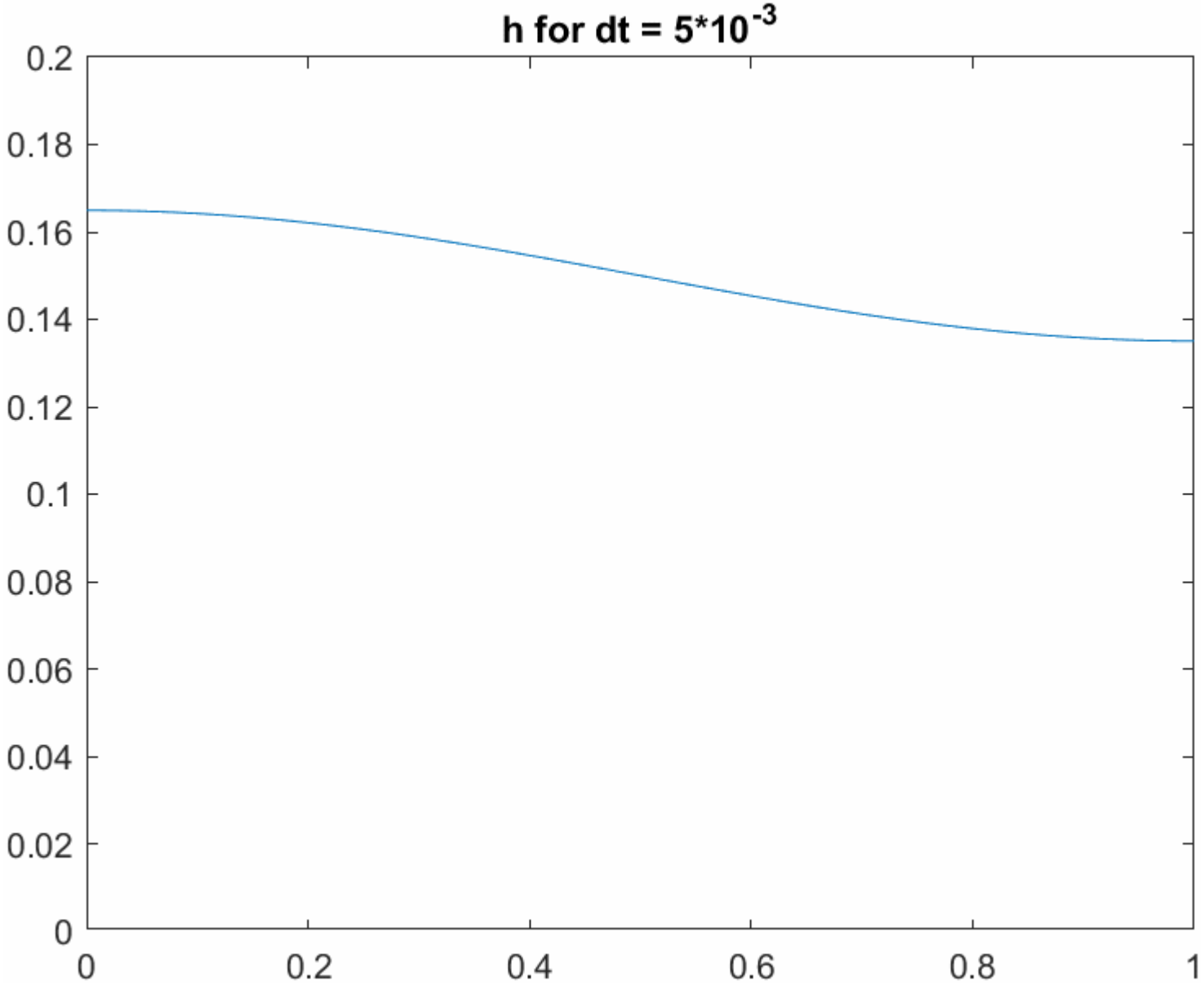
for variations,

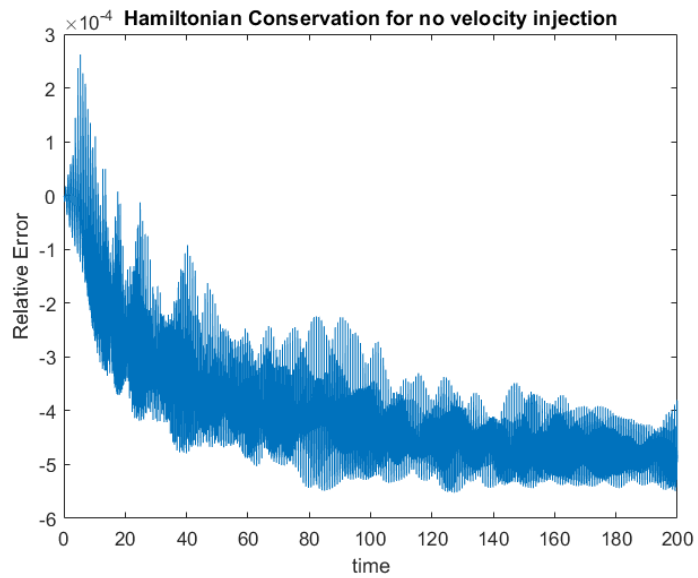
$$\delta\mathbf{u} = \dot{\mathbf{w}} + [\mathbf{w}, \mathbf{u}], \qquad \mathbf{w} = TR_{\eta^{-1}}\delta\eta.$$

Reduction!

+ Hamiltonian Mechanics

Pretty Pictures!


h for dt = 5*10^-3
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
0
0.2
0.4
0.6
0.8
1


×10^-4
Hamiltonian Conservation for no velocity injection
Relative Error
3
2
1
0
-1
-2
-3
-4
-5
-6
0
20
40
60
80
100
120
140
160
180
200
time