在幾何力學中 用能量的 E-L 方程推出 geodesic 方程是很自然的事。

1. [Geometric Analysis] Jurgen Jost p.23
2. [Geodesic Flows] Gabriel P. Paternain
3. [Geometric Mechanics] Darryl D Holm 群表現 幾何量子化
4. Symplectic Geometry V.I. Arnold(1937~2010)創立 Catastrophe theory
   1889 Darboux
   1899 Hertz
   1889 Henri Poincare
   1940 李華宗

[Symp 幾何] 數學傳播 39/2
[古典力學與辛流形]

$$\omega^{-1}=\frac{\partial}{\partial x}\wedge\frac{\partial}{\partial p}\ ,\ \omega^{-1}(df,dg)=\left(\frac{\partial}{\partial x}\wedge\frac{\partial}{\partial p}\right)(df,dg)=\frac{\partial f}{\partial x}\frac{\partial g}{\partial p}-\frac{\partial f}{\partial p}\frac{\partial g}{\partial x}=\{f,g\}$$

$$\because T\wedge S=T\otimes S-S\otimes T$$

$$\therefore\left(\frac{\partial}{\partial x}\wedge\frac{\partial}{\partial p}\right)(df,dg)=(\frac{\partial}{\partial x}\otimes\frac{\partial}{\partial p}-\frac{\partial}{\partial p}\otimes\frac{\partial}{\partial x})(df,dg)=\ldots$$

何謂 E8 Lie group？

宇宙的終極解釋來自幾何 A. Garrett Lisi

何謂量子化(quantization)

例 $M=R^2$

$L^2(R)=\{\ \}$ 所有實軸上平方可積函數所成的 Hilbert space

$Her(L^2(R))=\{\ \}$ $L^2(R)$ 上所有 Hermitian operator 所構成的空間

量子化就是李代數的同態 $C^\infty(R,C)\to Her(L^2(R))$