	LEC 12: EINSTEIN'S EQ. 28 FEB 19
	TODAY: ENERGY-MOMENTUM TENSOR
	GUESSING A PIBUS BOUAGION
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- Now With Table 100 miles 100 for the production of the Political and State 100 for the contract of the contr	
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CHENG 286	REVIEW: (CLASSICAL) BM IN COVARIANT FORMULATION
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	everything tensorial
	WITH MINKOWSK! SPACE
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	properties are marifest
-1997 to the distribution of the control of the con	
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arian and are at the last to the territory of the forest and the figure is been a finite full property and the last to the territory of the first to the fi	dF=0 GruFuzz =0 BIANOHi
- Albania	*d+F=j & Dr. FHV = jv from Action
· 3 Schiller volt var messermi å der kaster skill sociale ha omsemmer volter messe skill blinder. Messerve me	
at have and have all the constraint of many to the constraint of t	E is the tensor
	that contains the
**************************************	5m field
The state of the s	OURPENT 4-VECTOR

٠.

CURRENT: Z= (P, 4)

CHARGE DENSITY

CURRENT

CHARGE PER VOL

P = dq dx dydz CHARGE FERST PER TIME, PER CHOSS SEC. AREA

1x = 92 96



1)

or: gr = dg

infinit 3-volume Perpendialise to êm

CONSERVATION OF CHARGE: Or & = 0

p+7. = 0

SIMILARLY: MASS IS CONSERVED, COULD WRITE JAMES = (PMSS, James)

4 MOMENTUM CONSERVA	LION - BUERGY
Pr = (E, P)	Px, Py, Pz
<u></u>	O FOUR QUANTITIES
not a surrent, each	el
these is a charge	
	TPV = dpt/
THE CURRENT is:	
A 1000 may 1	rque my placement of indices.
BIG PIC: WILL WRONG A	FIEW ER. OF
THE FORM	
(CIVISAN)	ie) = (energy)
2-25	(-)
MUMURCIOUS TO:	
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olybuic	
INTUTUON: TOD	dE energy density
INTUITION: TOD	dx dy dz energy density
INTUITION: TOP	gx gh gs
	dx dy dz energy flux
	dx dy d? LE energy flux LE dy de ENERGY PER TIME
	dx dy d? LE energy flux LE dy de ENERGY PER TIME CROSSING dy de
	dx dy d? LE energy flux LE dy de ENERGY PER TIME

> dpi = dE |

To1 = dE = dPx = T10

Thom, say: D' = EV;

then Pi/pi = Vi/Vi

T is = T oi

stress-energy tensor

Total Control	
	Meaning of Tis
	momental accuental horner pros = breserve
	flux area time area
C-CENTRAL CONTRACTOR C	1
**************************************	PERP.
*	
Same Control Control of State Control	80: Txx is a pressure in x-dir
· j	
-con-conference	Txy is a shear force
-	

Para Marian Cara	EXAMPLES Uniform density
ACT OF LANCESCO CO. Co	EXAMPLES Uniform density
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- - - - - - - - - - - - - - - - - - -	DUST: NOU interacting barticle gloud
***************************************	modeled as a continuous medium
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WANTEN TERMINA	COMOVING COORDINATED: rest frame of the cloud
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NOVAKAMINOS AND USE AND USE OF THE PERSON NAMED IN COLUMN NAME	
- Anna Carlotte Comments	p not tensorial
	Town on the second of the seco
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the workships and	U=(1,5°)
	4-velocity
Navamon e compression de la compression della co	= PUTUV 2 of about
aparatra amin	
- Andrews of the Party of the P	
1	tensor eg.

IDEAL FUID:	"dust" whonly:	perpendial lar
	→ no shear	
	PRESSURE NO	SHEAR
T = / P		metaran tan
	PRESSURE	
= P. (5°5° - Pn ^w	+ Puru
= (P+3	B)Orov	

CONSERVATION OF PM > 10, THY =0 maybe eg. rederiving Huid mechanics ity! from morrelativistic limit of ideal fluid 2,Trv = 2+ (p+P) 2+UV + (p+P) (2-UT) UV + (---) 57 2- 57 - 3 B Strategy: many components. let's project onto 2 subspaces: 11 to OM (1D) I to Ur (BD) U is sheady a normalized projector ie U.V gives prajection of V onto U Uv(2+F)UF = 2+(P+F)UF + (P+P) U, [UDO auth 1 50 20 18 + 20 1 - Uror P

$$U_{1}(3+T+1) = U.3(P+E) + (P+E) U^{2} 3.U - (U-3)P$$

NR umit:
$$U = (1, y)$$
 | $y | (x | 1)$

$$U^2 = (1 | y)$$

$$U^2 = (1 | y)$$

$$V | (y^2)$$

$$V | (y^2)$$

$$V | (y^2)$$

CONTINUITY EQ FOR ENERBY DENSITY

2) ALSO WANT TO PROJECT 2, The onto

3D SUBSPACE I TO U.

1 PROJECTION CENSOR

(Proj'' = S', -U'U, J'eg. CHECK IN

(Pros) " 2 pT TV = (P+P)(0,20)V2 - (P+P)(0,20)V2 (-1-) V2-V2 - (-1-)U1 V2(0,0) + U 4 U 2 V P NR UMIT P(0.3) 2 - 3 2 - 2 C(0.3) P 6(3° \(\lambda\) + (\(\lambda\) \(\lambda\) - \(\Delta\) + \(\Delta\) (\(\delta\) + \(\Delta\) \(\Delta\) \(\Delta\) d = 1 hige on V 312 THE SOMMA CONVECTIVE DERV. $(\Lambda \cdot \Delta) \Lambda$ THIS COMES UP IN GALAXY EVOLUTION

	BEW: to 30 to conned above
	good rule of thumb: 2-2D
salienkki – Automos vij 25 konsen Armoni Ark London umbor vo se nasov vi sa.	en: maxine in overto space
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n GRAN	
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C85	
er verm som til state som	
	eg Or + FMP2 + FVFP2 = jv
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An the difference we will not the desirable of the original and the origin	*
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Norwick and Children (1945 - mailing Normick Institution and American American	duis is a R!
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f(R.	.) =	KTW	
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KM3.

dandenbadestlavs that	there's another than to make a symmetric
and the state of t	there's another throug to make a symmetric tensor floating around: 9 m.
AND AND THE SECOND	7
Ballya Weta assume Olda's parame	BUT JON ISN'T A CURVATURES
ningan diametrality and	that's fine. JUST SLAP A SCHUR CURVATURE
udan geralaman majarah geralam	MEASURE NEXT TO IT.
-	A 2 W
- The second second	R=Rmgm, RICCI SCALAR
Maracon Contraction	
	this is sym, related to arreture
***************************************	also not obviously covariantly constant
annocumus annocumu	(POTE 18 - 18 - 20 - 20 - 20 - 20 - 20 - 20 - 20 - 2
-	Onton Tile
Annual An	CONSIDER, THEN,
And the second second	ARm + BRgm

***************************************	in fact: sufficient to ansider
THE STREET PERSONS AND ADDRESS	[Rw + DRgw]
***************************************	WANT D s.t. Dr (Rrv + DRgru) =0

C-Finalities obtainment and	WHAT you've show on thu: D= ->
habiteralismustaream	
-	

80 WE DEFINE THE EINSTEIN TENSOR	
Cam = Rm - ERgn 2 symmetric, conserved/cov. const. goes like of	
DO WE CAN OVERS:	
convolure 1 energy (stuff)	
oupling NG NG BREEVE: The =0 -> Gm =6	
this means: 1R pr == vacoum en	•
eg. Rm = 0 for sources!)	

for moterning to Newtonian Unit

gto (Bru- = Rgm) = gto KTm

R-2R = KT ~ T=T+

-> R = -KT]

then:

Rm = K(Tm + = Tgm)

then: (HW)

 $R_{00} = + \frac{1}{2} \nabla^2 g_{00}$ M NEWTONIAN WMT? Sign? (1+24)

BHS:

K (Too - 2Tgoo)

T = 900 Too + SMALL

s.t. 2T900 = 29°900 Too

	80: Roo = +27°900 = 2KT00 = 2KP	aran anna ann an Antalannach
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n _{real} (1) group (1) de distribute de l'accessor de l'acc	(1+24)	na a a sainn ann 136 mh Thomas Ann a bh
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rall security for the control of the	$\nabla^2 \phi = \left \frac{1}{2} K \right P = 4\pi G P$	المنافق من المناسب من الم
		#Hemility Problem Association
		ng paga Salagahan galik galaman erken
	⇒ K : 8πG	**************************************
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		and the second s

zee IV.1	Another Way.
SUPZI	FREE PARTICLE ACTION [8=-m]dT]
•	N N m dx r dx
	elegant, covariant what else could it be?
	$S = \int_{a}^{a} dt \left(M + \frac{1}{2} M \left(\frac{1}{2} \right)^{2} + - \right)$ overall const. kin 5.
	IN NR LIMIT, WE BET GROWNRY MERHANICS
	Sne = ldt \frac{1}{2}m(\frac{d\tilde{x}}{dt})^2 - V(x) ASTENTIAL
	external Brows Wat
j)	me stick or in , eighad,
The state of the s	HOW TO INCORPORATE V(X) M PEL Way?
•	

mside
$$D$$
 $S = -\int M \sqrt{\eta_{H} dx^{r} dx^{v}} + V(x) dt$

outside D $S = -M \sqrt{(1+\frac{2v}{M})} dt^{2} - dx^{2}$

$$-M \sqrt{(1+\frac{2v}{M})} dt - \frac{1}{2} \sqrt{(1+\frac{2w}{M})} dt$$

$$\approx -M \sqrt{(1+\frac{2w}{M})} dt - \frac{1}{2} \frac{dx^{2}}{dt}$$

$$= \int dt \frac{1}{2} M \left(\frac{dx}{dt}\right)^{2} - V - M$$
?

but: neither I nor 11 is really loftered mut!

from ELECTRONAC.

enamente de la composition della composition del	ID need at idx on equal footing:
	S=-Md/gma)dxtdx
	Mside V
	this is indeed the action. Cor a particle in a grav.
	field—as we have assumed!
	what about the dynamics of GRAVICY HEER?
	S ~ I d4x staj R(x)
	Elor sching
	CONFINIT
	My: "UNIQUENESS" OF ENVERTIN FOR IS MANIFEST FROM PIMENSIONAR ANALYSS
	RND2 -> const ~ //ou2 ~ d
er en	often fours group as conducted -> HIRHER O'IN C

HAKING THE BOURCE- FREE EINSTEN EAN
88 - 8 8 44 x Jg R
C NARY MILT MHATS &M
= 8 d4x Ng [KW] 89m
DERNE
ther 88=0 => Km=0
$R \sim 3\Gamma \sim 3^2 g \rightarrow so K^{\mu\nu}$ must have $1 \qquad two derivatives$ $also \Gamma^2 \sim (Eg)^2$
80: 2-tensor that is $O(92)$ Some As Refore: Km ~ Rm + DymR
then KW=0 >> 9m KW=0 R+4DR=0
either D=-14, [R=0]

W: A , weller ADDING IN SOUPE Sex = TETTE Jdx Ng R S stuff 19 8gm PROPERCIES: SYM. 2-INDEX REALSOR FIRED ANOTHER PICTURE: persity current n+(x) = 2 | dta dga S(a) (x- ga(t) flow of particle sum over dust particles in descetur herves to anymod win: 8(3)(x) = [dz 8(x=-g=(z)) 8(3)(x)

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= ldz dz 8(x g) 8(x z) = n°

then electric anneal

Jr = E ea ldZa dZa 8(m) (x-ga(Za))

Conorge
of atm

then the 4-momentum ament:

TW = 2) dTa = 280 (Pa) 8(4) (x-8a(Ta))

plays role of eq

= = JdTa (Ma ga ga) 8(m) (x-galta)

o = ddta