

Destroying Momentum: Puzzling Net- p vs. Total- p

Professor Du-Ane Du

www.Wacky1301SCI.com, "Looking at serious science, sideways!"

As a matter of routine, scientists mathematically destroy and create momentum almost on a daily basis. In fact, momentum is often destroyed by the very equations that claim to preserve it! Solve these puzzles and discover: why? how? and does it matter?

—By Du-Ane Du, Author of *Murdered Energy Mysteries*, (Amazon, Kindle, ebook 2018, paperback 2021).

Let's examine some puzzles to see how the differences between net v -momentum and total s -momentum affect our interpretation of different situations. (For more information, see Chapter 2 of *Murdered Energy Mysteries*, and "The Unusual Powers of Speed-Momentum" at www.Wacky1301SCI.com)

As a quick review, v-momentum, or velocity-momentum is a vector, and it has directionality. Eastward is positive, Westward is negative, North is positive, South is negative, etc. Net v-momentum, then is the directional sum, where negative cancels positive. The generic formula for net v-momentum is:

$$\text{net } v\text{-momentum} = m_1v_1 + m_2v_2$$

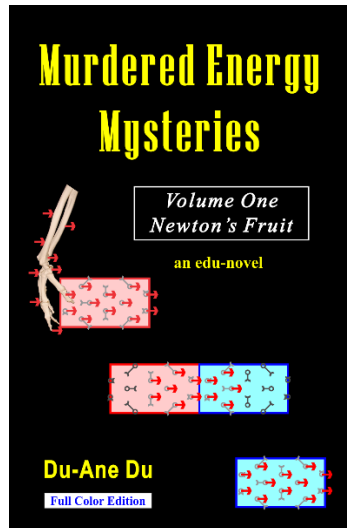
In contrast, s-momentum, or speed-momentum, is a scalar and that does not have directionality. S-momentum can never be negative, just as speed can never be negative. Total s-momentum is the non-directional sum of the absolute measures:

$$\text{total } s\text{-momentum} = |m_1v_1| + |m_2v_2|$$

Net or Total, which is more accurate, or more reliable? Calculate and explore the following puzzles:

- 1) Cyle has received a kickoff for his football team, and Cyle is about to pick the ball up off the ground. 100 kg Marque is running toward Cyle at an east-based velocity of

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+20 m/s, and 150 kg Rogue is running toward Cyle at an east-based velocity of -10 m/s.

- What is Marque's v-momentum?
- What is Rogue's v-momentum?
- What is the net v-momentum of Marque and Rogue together?
- What is the total s-momentum of Marque and Rogue together?
- What is Marque and Rogue's average s-momentum?
- If both Marque and Rogue arrive simultaneously and if Cyle is unable to escape, which of the above values is the most accurate predictor of the amount of impulse/momentum-transfer that Cyle will experience during the collision? (C, D, or E)

2) LeShay and Ingram are creating a marble sculpture.

LeShay swings a 0.2 kg hammer toward the marble sculpture at a north-based velocity of $+0.4$ m/s, and Ingram swings a 0.7 kg mallet toward the sculpture at a north-based velocity of -1.2 m/s.

- What is the v-momentum of LeShay's hammer?
- What is the v-momentum of Ingram's mallet?
- What is the net v-momentum of the hammer and mallet together?

- d) What is the total s-momentum of the hammer and mallet together?
- e) What is the average s-momentum of the hammer and mallet?
- f) If both girls strike the marble sculpture at the same time, which of the above values is the most accurate predictor of the amount of impulse/momentum-transfer experienced by the sculpture? (C, D, or E)

Now consider the following excerpts from the Index of Secret Facts, *Murdered Energy Mysteries*:

Cartesian #1 general conservation fact of motion/momentum [Descartes] (Chapter 101): The total amount of motion/momentum in the universe never changes, therefore Object A cannot speed up unless a second object slows down, likewise Object B cannot slow down unless one or more other objects speeds up.

Cartesian #2 clarified conservation fact of r-s-t momentum [Descartes] (Chapter 101): Radian/speed/trapped momentum can change forms (radian, speed, or trapped), r-s-t momentum can change natures (linear, multidirectional, or omnidirectional), and r-s-t momentum can be transferred from one object to another, but the total amount of r-s-t momentum in the universe never changes.

Cartesian #3 conservation impulse corollary [Descartes] (Chapter 104): Object A's motion/momentum will not change unless (1) an impulse transfers momentum from Object B to A, usually

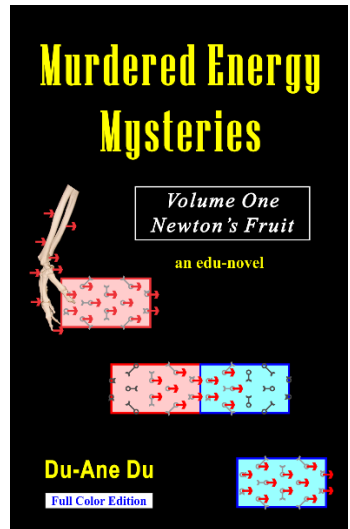
causing A to speed up, or (2) the impulse could transfer momentum from Object A to B, usually causing A to slow down, or (3) the impulse could transfer momentum out of a trapped or multidirectional state, usually causing A to speed up, or (4) momentum could be transferred away from A and into a trapped or multidirectional state, usually causing A to slow.

Cartesian #4 constancy fact for total numerical momentum [Descartes] (Chapter E03): The numerical total of radian/speed/trapped momentum of a system after an experiment will always be equal to the numerical total before the experiment—the fact that the momentum may have changed forms does not affect the numerical sum.

(Example: (A) 1 ρ of forward speed-momentum is always equal to 1 ρ rad of r-momentum, and (B) 1 ρ rad of radian/angular momentum is always equal to 1 ρ of trapped-momentum, and (C) 1 ρ of t-momentum is always equal to 1 ρ of s-momentum, etc.)

- 3) According to the conservation facts for r-s-t momentum, can negative momentum ever cancel out positive momentum? Why?
- 4) Can momentum ever have a negative magnitude? Why?
- 5) Is the addition of negative and positive momentum a violation of the fact of r-s-t momentum conservation? Why?
- 6) Sally's car has stalled in the middle of an intersection. A 30,000 kg truck is approaching her at a north-based velocity of +30 m/s, and a 2,000 kg sports car is approaching her at a north-based velocity of -40 m/s.

- What is the v-momentum of the truck?
- What is the v-momentum of the sports car?
- What is the net v-momentum of the truck and sports car together?
- What is the total s-momentum of the truck and sports car together?
- What is the average s-momentum of the truck and sports car?
- If Sally is unable to restart her car, and both approach vehicles enter the intersection at the same time, which of the above values is the most accurate predictor of the amount of impulse/momentum-transfer that Sally's car will experience during the collision? (C, D, or E)



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[Murdered Energy Mysteries](#)

seeks to increase understanding of the various forms of momentum and momentum transfer, as well as the various forms of energy and energy transfer. The lack of understanding on the part of the scientific community is substantial, and more research needs to be done.

—Du-Ane Du, author of the edu-novel [Murdered Energy Mysteries](#) (Amazon, Kindle, e-book 2018, paperback 2021.)

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